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The modern journal of classic aeroplanes and the history of flying

Taking the Seafire to sea . . .

issue no 4

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Published by:
The Aviation Historian
PO Box 962
Horsham RH12 9PP
United Kingdom

Subscribe at:
www.theaviationhistorian.com

ISSUE NUMBER 4
(published July 2013)

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Published quarterly by *The Aviation Historian*, PO Box 962, Horsham RH12 9PP, United Kingdom

© *The Aviation Historian* 2013
ISSN 2051-1930 (print)
ISSN 2051-7602 (digital)

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Editor's Letter

TO USE A very well-worn phrase, time really does fly when you're enjoying yourself, and I'm delighted to be welcoming you to the fourth issue of *TAH* already. Once again we take an in-depth look at some lesser-known subjects, ranging this time from British blimps to Black Widows and atomic engines to amphibians.

We also explore an important subject which has generated a veritable beehive of commentary, exegesis, speculation — and, at times, downright silliness — within the early aviation history community; the recently-revived claim that in 1901 German-born American resident Gustave Whitehead made the first manned, powered, controlled and sustained aeroplane flight, two years before the Wright Brothers.

It is a theory that has resurfaced regularly for decades, and one that has so far consistently been found wanting in terms of hard facts. We take a forensic look at new material put forward by German-based researcher John Brown — and, controversially, accepted at face value by *Jane's All The World's Aircraft*. Does this new information potentially change "ground zero" for aviation history and relegate the Wrights to also-rans? Our analysis of this latest claim, and what it means, begins on page 82 . . .

FRONT COVER ***A superb wartime colour image of a Royal Naval Volunteer Reserve lieutenant standing beside his Supermarine Seafire. David "Shorty" Hamilton's recollections of learning to "land on" in the Seafire XV and XVII start on page 10.*** THE ALPHA ARCHIVE

BACK COVER MAIN ***Hawker Siddeley Harrier Mk 52 G-VTOL and Aermacchi MB-326K prototype I-KMAK at Santa Cruz in 1973.***
TOP LEFT ***The sole Convair NB-36H, fitted with a nuclear reactor.***
TOP RIGHT ***Another day, another dollar for a Southern Martin 4-0-4.***

The Cody Statue Project

TOP LEFT Sculptor Vivien Mallock's clay maquette of the statue. LEFT "Cody's Tree", a famous Farnborough landmark. BACKGROUND An artist's impression of the finished statue adjacent to the FAST Museum.

FOLLOWING THE SUCCESSFUL creation in 2008 of a full-size replica of S.F. Cody's British Army Aeroplane No 1, the first aeroplane to make a powered, controlled, sustained flight in Great Britain in October 1908, the Farnborough Air Sciences Trust (FAST), in conjunction with Rushmoor Borough Council, Hampshire County Council and Rushmoor Rotary Club, is planning to commemorate in August 2013 the death of this pioneer aviator, who perished when his aeroplane broke up in the air, close to Ball Hill, near Farnborough. The centenary of this tragic event will be marked by the unveiling of a life-size bronze statue of Cody, in a prominent position by Farnborough Road, close to both the former South Gate entrance to the Royal Aircraft Establishment and the original position of the famous Cody's Tree, and beside the FAST Museum. The statue has already been commissioned from well-known sculptor Vivien Mallock.

FAST is now seeking donations towards the considerable cost of this statue and the works surrounding it. You can play your part in helping to commemorate this aeronautical pioneer and hero by sending a cheque to The FAST Cody Statue Project or by purchasing a commemorative brick, which will be laid in the paved area surrounding the statue. It is intended to engrave these with the names of individuals and the names of company sponsors. So, if you would like to associate your own name, or that of a relative or friend, permanently with Farnborough's unique aviation history, contact FAST at the telephone number in the panel below, or online.

Farnborough Air Sciences Trust, Trenchard House, 85 Farnborough Road, Farnborough, GU14 6TF. Tel 01252 375050 (office manned Sat/Tue/Thur). Websites: www.airsciences.org.uk, www.codystatue.org.uk, www.sfcody.org.uk

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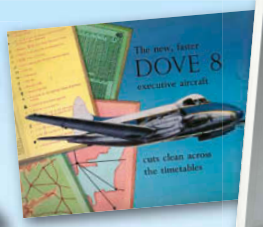

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AIR correspondence

Letters to The Editor

Missing zeroes?

SIR — I am a little confused about the costs stated in Erik Simonsen's *Project Terminated* article on the Avro Canada Arrow in *TAH3* for supply of that aircraft to the UK. It states that for aircraft produced in Canada the quoted figure would be C$2·1m for each unit, yet for those constructed in the UK it would be only $370,000. Yet the article states that it was for economic reasons that the aircraft would not be produced in the UK. Is this a printer's error? Should there be a further "0" added to the UK figure, which is less than one sixth of the alternative? I also wonder if there was a certain influence by a neighbouring country, afraid that it would be a superior aircraft to what they were looking at (shades of TSR.2 and Miles M.52).

Les Bray *St Albans, Herts, via e-mail*

Erik Simonsen replies:

I have subsequently reviewed my notes and the reference I used was from a magazine article by renowned author and aviation expert, Tony Buttler. His article, entitled *Arrow Secrets*, appeared in *Air Enthusiast* No 89, September/October 2000. I contacted Tony regarding this and he re-checked his reference from a British Air Council document dated February 24, 1956. The result was that Tony admitted he may have not correctly added two figures on the chart that would have increased the UK Arrow unit cost, but not overwhelmingly.

What is not clear in the 1956 document is whether the PS.13 Iroquois engines would have been included in the UK deal. The UK was considering using its own powerplant (two engines per aircraft). Thus, I believe the low figure is for the airframe only. Additionally, there was consideration to have the aircraft segments manufactured in Canada, and shipped to the UK for final assembly. There the UK engines and other subsystems would be installed.

Quoting aircraft unit costs can be tricky and Tony mentioned that he avoids this when possible, but he thought the British Air Council data would work in his article. In my Arrow chapter, I wanted to show that the cost of procuring the Arrow was feasible, and decades later would seem quite a bargain.

For example, I am currently researching the Lockheed Martin F-35 JSF, and there is one estimate from December 2012 of $114·3m per aircraft ("A" variant) without the "single" Pratt & Whitney F135 engine. And with the F135 engine, the unit cost is $146·3m per aircraft — a dramatic increase.

The UK Arrow unit cost estimate was indeed a low figure, but I also believe it is because of

ABOVE ***An unmissable bargain? Avro Canada CF-105 Arrow second prototype RL202 on a test flight with a Canadair CL-13 Sabre chase aircraft. This Arrow reached Mach 1·96, the highest speed recorded by the type.***

Send readers' letters for publication to: Air Correspondence, The Aviation Historian, PO Box 962, Horsham RH12 9PP, UK, or (preferably) e-mail them to the Managing Editor at mickoakey@theaviationhistorian.com

variations of the export deal being considered:

- The Canadians desperately wanted to save the programme and Canadian jobs, and exporting the Arrow would increase the production number and lower the overall cost. Thus, they came up with a very attractive price.
- The aircraft segments would be manufactured in Canada and assembled in the UK.
- The fire control system would be retained, but the British would supply the engines (unit cost apparently doesn't include engines).

The USA may have had a hand in discouraging the British in procuring the aircraft (the USA was interested in exporting aircraft to the UK). This American pressure may have influenced the UK not to procure the Arrow, even though it was an excellent deal.

The USA was also trying to convince the Canadians that fighters/manned interceptors were soon to be obsolete and missiles were the future. Very bad advice.

If we have another print-run of my *Project Terminated* book, I will restructure this data to result in a more accurate unit cost figure. Thanks for the sharp eye!

Compact format — the real reason

SIR — Last night reading *TAH2* and looking at the favourable comments in *Air Correspondence* made me think that these knowledgeable guys are missing the point.

The point is that the size you've chosen for the journal makes for easy night-time reading in bed.

John E. Wells *Richmond, Vic, Australia, via e-mail*

Straightening the record

SIR — It is refreshing to see an international magazine that expands into aspects of aviation history outside the dominant Anglo-American tradition, as with the Francesco de Pinedo article by the late Johnny de Uphaugh in *TAH2*. Because Italian airmen are little-known outside their country of origin, I believe that it might be useful to straighten the record before some of its minor inaccuracies become accepted fact.

While Italo Balbo was arguably the key Italian inter-war aviation figure, he was not appointed head of the newly-formed independent Air Force in 1923 (p16). In fact Balbo was never the military head of the Air Force, for which there was a Chief of Air Staff, much in the way that in Britain Harold Balfour was Under-Secretary of State for Air and Hugh Trenchard was Chief of Staff. He was instead named Under-Secretary to the Air Ministry in November 1926, three-and-a-half a years after the new service was created, and was promoted Air Minister in 1929.

The poet Gabriele D'Annunzio was never a fighter pilot (p26). In fact, he was never a pilot at

TAH around the world . . .

A SHORT WHILE AGO we started a thread on this journal's Facebook page (www.facebook.com/TheAviationHistorian) encouraging readers to post or send in photographs of* The Aviation Historian *in unusual locations across the globe. Canada-based reader Doug Fisher seized the challenge and took Issue 3 with him on a tour of the Canadian Warplane Heritage Museum at Hamilton, Ontario. It is seen here being pressed against the bomb-aimer's window of airworthy CWH Avro Lancaster FM213 by Flight Engineer Randy Straughan. Where will be next?

all, his considerable operational flying activity being always and solely as observer.

As for de Pinedo, it was not a mechanic who caused the fire that consumed his SIAI-Marchetti SM.55 at Roosevelt Lake (p21, a place where a seaplane would more easily alight than land).

The dubious honour goes to John Thomason, a 17-year-old who with Jack Williams and Albert Evans had gone out to the *Santa Maria* in a boat. "We were all in the boat after it had been refuelled, when it was ready to leave", said Thomason in a written statement obtained by F.G. Gray of the *Arizona Republican* newspaper. "Colonel Penido [*sic*] was shaking hands with Roland Still, saying goodbye, when I lit a cigarette and threw the match into the water. There was an immediate flash, and the flames started from the water to the boat. I knew there was gasoline on the water, but did not think it would burn."

Space prevents a detailed examination of the Balbo-de Pinedo relationship, but it should be noted that the Eastern Mediterranean cruise took place in 1929, not 1930 (p23).

Finally, may I point out that the correct spelling of the patron saint of Naples is Gennaro, not Gennario. The historic flying-boat bearing the affectionate *Gennariello* ("little Gennaro", or "Sweet Gennaro") was preserved and was found by Australian personnel at the former Guidonia test centre after the liberation of Rome on June 4, 1944. Perhaps recognising the RAAF crest painted on the bow, the official photographer documented it before the aircraft was forever lost.

Congratulations for taking on such non-mainstream subjects.

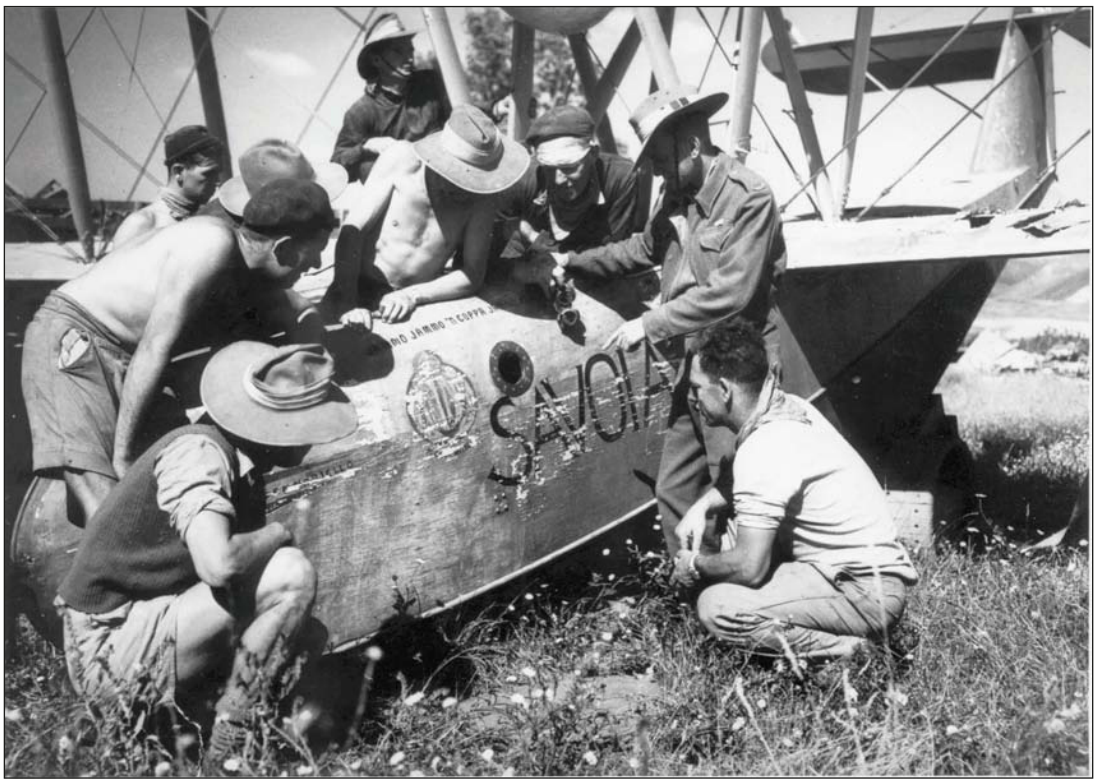
Gregory Alegi *Rome, Italy, via e-mail*

Keep calm and carry on

SIR — Just received Issue 3 in Australia. You guys know what you're doing. Carry on.

I should have added "and on and on and on". The purest aviation history periodical on the market.

Andy Wright *W. Wyalong, NSW, via Facebook*



ABOVE ***Australian servicemen pose with Francesco de Pinedo's SIAI S.16ter at Guidonia, north-east of Rome, having found it there when the Italian capital was liberated in June 1944, 19 years after the flying-boat's epic Far East flight.***

Ian Bott Illustration

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Ford Mustang and de Havilland Vampire at Bonhams' sale of classic cars in the RAF Museum Hendon, April 2010

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TAKING THE SEAFIRE TO SEA

In 1948, having acquired his Royal Navy wings on Tiger Moths and Harvards, **COMMANDER DAVID "SHORTY" HAMILTON** was ready to take on the challenges of making deck-landings and take-offs in the demanding Seafire. He puts us in the cockpit of his Seafire Mk XV to describe his deck-training, and talks us through his first landing on a carrier

FIRST, IT IS worth noting the main differences between a standard Spitfire as used by the RAF and the navalised Seafire. The latter was fitted with foldable wings, the folding being performed manually, a "sting"-type arrester hook carried under the rudder, longer-stroke undercarriage oleos to absorb the deck-landing impact and, in the case of the Seafire XVII, fittings to allow for catapult launches. Other additions included a strut installed forward of the tailwheel to stop an arrester wire tearing it off and a green indicator light in the cockpit to show that the hook was down. A feature that is rarely mentioned was the introduction of treadless tyres, so that any sideways strain on the undercarriage during deck landing could be absorbed by skidding. Anyone who had flown the Rolls-Royce Merlin-engined Seafire had to remember that the same company's Griffon drove the propeller in the opposite direction, and so rudder trim would have to be reversed.

GOING SOLO

The chief advantage of World War Two-vintage fighter airfields was that they were grass and an aircraft could therefore taxy more or less straight to its take-off point. Airfields built after the war, however, had perimeter tracks, which had an indirect effect on the handling of the Seafire/Spitfire. The types' engine coolant radiators were small and one had to taxy along the track until reaching the duty runway. Furthermore, a single-engined taildragging aircraft required its pilot to zigzag all the way, in order to be able to see directly ahead. These two factors sometimes led to insufficient cooling air passing through the radiators, causing the engine to boil. Then you had to switch off and wait for a tractor to tow you back to dispersal. As a result, one taxied as fast as possible without overdoing things.

The cockpit was small, but just right for me and one felt very much a part of the aircraft. There had been no thought of ergonomics: buttons, levers and switches were placed wherever it was convenient for the designer or manufacturer. After start-up, and with engine temperature and pressures correct, the engine was run up to high revs to check for magneto drop, but not before getting a member of the groundcrew to stand in front of the tailplane, lean over and put all his weight on it. If this was not done the slipstream could lift the tail off the ground and dig the propeller into it.

Having reached the runway and performed the necessary cockpit checks, which included full left rudder trim, you opened the throttle and, in spite of full trim, found yourself still having to add left rudder to keep straight. Having applied full throttle, there was still a likelihood that you would wander off to starboard; while trying to counteract that you would then realise that the aircraft is airborne and skidding madly.

The next task was to raise the wheels before the airspeed limit was reached and, at the same time, wind off the full left rudder trim. The trimwheel was on your left side near the floor but the undercarriage lever was on the right sidewall — three hands would have been extremely useful!

LEFT ***The author (middle) with a pair of his 767 Sqn mates aboard*** **HMS Implacable** ***in June 1948. Pilots flying with the unit were often referred to as "clockwork mice", 767 being a dedicated deck-landing training squadron, with its aircraft performing Aerodrome Dummy Deck Landings (ADDLs) and circuits constantly; take-off, downwind, finals, land — repeat — just like a clockwork mouse.***

PHOTOGRAPHS VIA AUTHOR UNLESS OTHERWISE STATED

BELOW ***Cunliffe-Owen-built Supermarine Seafire F.XV PR431 of No 804 Sqn departs*** **HMS Theseus** ***during the type's tenure with the unit during 1946–48. The Seafire XV was an upgraded Griffon-engined version of the naval fighter and first flew in February 1944. The Mk XV was a marked improvement over the preceding Seafire III, being capable of nearly 400 m.p.h. (645km/h) and a rate of climb of more than 4,000ft/min (1,200m/min).***

The Seafire Mk XVII, also flown by the author during training, was a further modified Mk XV fitted with a cut-down rear fuselage and "teardrop"-style canopy to bring the type into line with the RAF's Mk XIV. **BELOW LEFT** *Another snap of the author (second from right) aboard* **HMS Implacable** *in June 1948.*

MAIN PIC: PHILIP JARRETT COLLECTION

"THE SEAFIRE WOULD BE WANDERING ABOUT LIKE A DRUNKEN SAILOR WHILE YOUR CHUMS WERE STANDING ON THE TARMAC HAVING A GOOD LAUGH . . ."

The undercarriage had to come first. So, you would take your left hand off the trimwheel and transfer it to the control column and then grab the undercarriage lever with your right hand. You would move the latter down, pull to the left, swing it up through about 90°, push it to the right and then down, to lock it. Then there would be another change of hands to wind off the trim. While this was going on the Seafire would be wandering about like a drunken sailor and your chums would be standing on the tarmac having a good laugh.

The remainder of the flight was magic and the landing a doddle because your heart rate was back to normal and the brain untoppled. The first question you would be asked on your return was always, "How high were you when you got the gear up?". It soon became the norm to take off with less than full throttle.

BECOMING A CLOCKWORK MOUSE

When learning deck-landing techniques at shore-based airfields the circuit height was reduced from the standard 1,000ft (300m) to 300ft (90m), closer to that used for carrier landings. From then on every landing you made was from that height, which rather annoyed the RAF at their airfields — but who cared?

From a standard square Tiger Moth and Harvard circuit one changed to 180° banked turns at the end of each straight. At the end of the downwind leg, a steady descending curve to the runway, with some throttle applied, was the aim. The two reasons were, first, one could see the runway out of the left-hand side of the windscreen all the way until the wings were levelled at the last minute and, secondly, a nose-up three-point attitude had to be carefully maintained at the lower end of the speed range. These two factors were of major importance when deck landing. The correct airspeed was critical for landing on a deck, whereas a few knots' variation was not life-threatening on a runway, it just meant that you landed a bit further along it.

At the end of Operational Flying School our group moved to RNAS Milltown, a satellite airfield about ten miles from Lossiemouth, to start intensive Aerodrome Dummy Deck Landings (ADDLs). We flew carrier-style circuits all day, doing touch-and-goes each time, under the orders of the Deck Landing Control Officer (DLCO), who stood on the left side of the runway, which

was marked out with white paint, as a flight-deck landing area. Because he signalled with a table tennis-like bat in each hand he was called a "Batsman" — or "bats" for short. His signals indicated corrections regarding height — up or down; direction — more or less bank, and speed — faster or slower.

If you were flying the correct approach the bats were held horizontally at shoulder height — the "roger"; if an incorrect one, the bats were waved over the head — the "wave-off" — and one went round again. The batsman was always an experienced deck-landing pilot. The average session was six ADDLs in about 20min and there were several sessions a day. One was usually considered ready to deck-land after about 100 ADDLs.

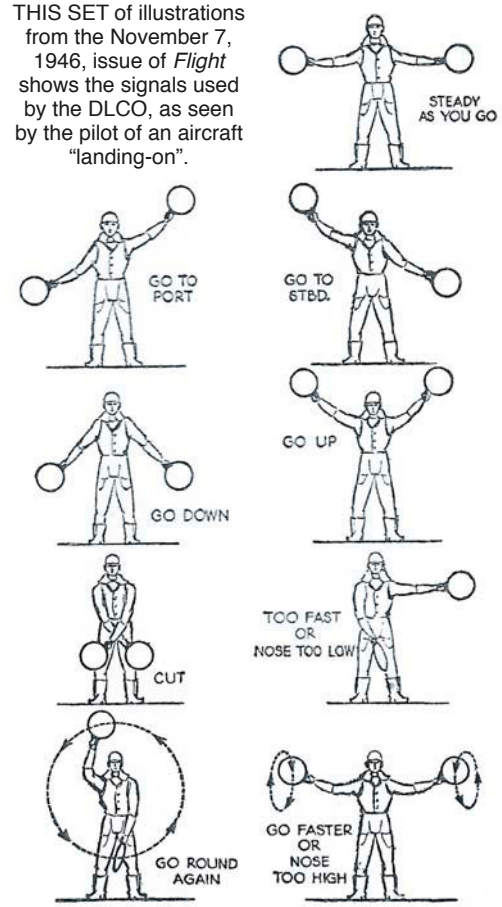
THE FIRST DECK LANDING . . .

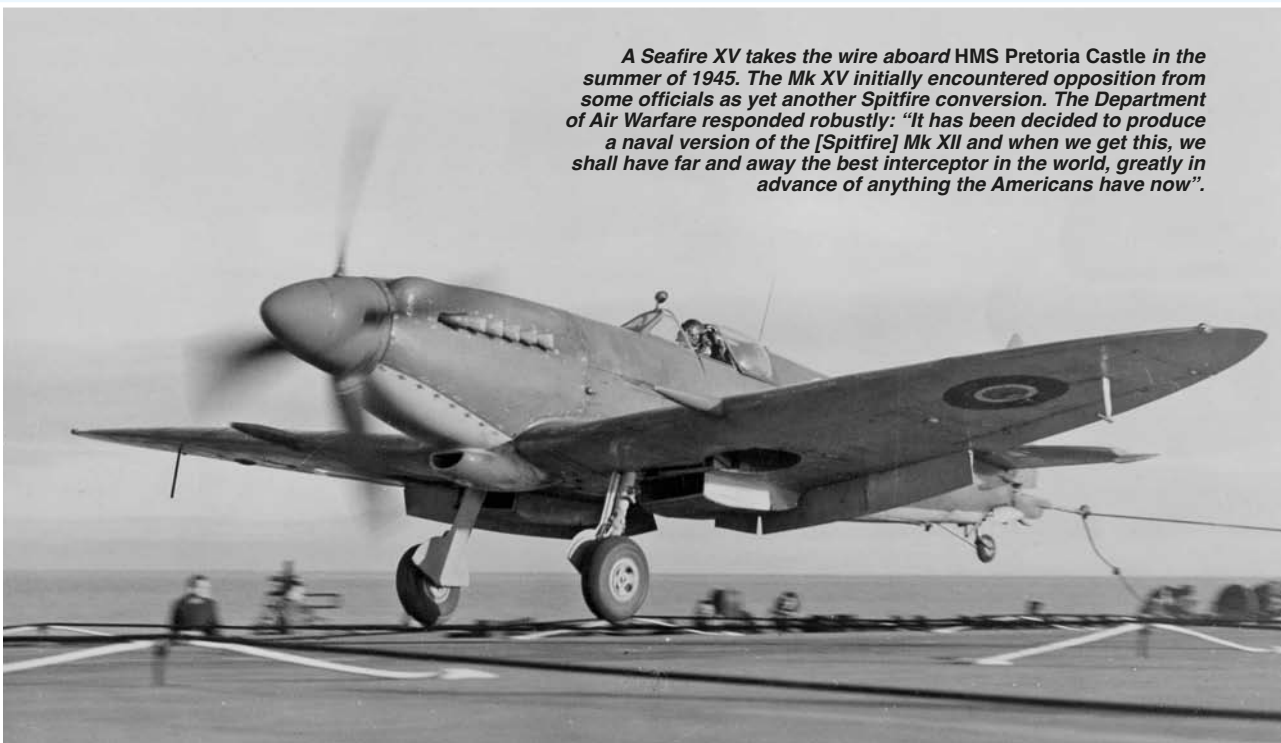
By the summer of 1948 we were finally ready. We were to rendezvous with the fleet aircraft carrier *HMS Implacable* in the English Channel and flew south in pairs, refuelling at RAF Acklington and RAF Waddington on the way, finishing at RNAS Lee-on-Solent on the South Coast.

There were two major handling matters with the Seafire to bear in mind when taking it to the deck. First, the aircraft was small, with a large amount of horsepower up front. If the batsman gave you a very late wave-off and you slammed open the throttle at slow speed, the aircraft tried to rotate around the propeller — a torque stall, which was usually fatal. Secondly, the Seafire had a very low-drag airframe and if you were only a little fast on landing it was possible to

THE BATSMAN'S SIGNALS

THIS SET of illustrations from the November 7, 1946, issue of *Flight* shows the signals used by the DLCO, as seen by the pilot of an aircraft "landing-on".





A Seafire XV takes the wire aboard* HMS Pretoria Castle *in the summer of 1945. The Mk XV initially encountered opposition from some officials as yet another Spitfire conversion. The Department of Air Warfare responded robustly: "It has been decided to produce a naval version of the [Spitfire] Mk XII and when we get this, we shall have far and away the best interceptor in the world, greatly in advance of anything the Americans have now".

With "sting" hook down, this Seafire XVII has been given the "wave-off" and will have to go around again. Opening the throttle too sharply at this point could result in a torque stall — gently does it!

PHILIP JARRETT COLLECTION

LEE HOWARD

ABOVE ***The somewhat snug cockpit of Seafire XVII survivor SX336/G-KASX, owned by Kennet Aviation and currently under rebuild at North Weald. In common with many British wartime-era aircraft, there was little thought for ergonomics, with instruments being fitted where there was room. Note the "basic six" flight instruments in front of the control stick.***

float gracefully over all ten wires into the crash barrier. Food for thought.

On June 22, 1948, I flew out to the ship, which was steaming in Lyme Bay. On arrival I was instructed over my four-channel VHF radio to join the circuit and land. Flying up the starboard side of the ship one could see the red and white "Aeroplane" flag displayed at the yardarm. This indicated to all ship traffic that the carrier was operating aircraft and to keep clear.

Passing up the ship's starboard side at 300ft (90m) and 150kt (280km/h), I closed the throttle and made a 180° turn to port. By the time that was done the speed had dropped below the ton. The undercarriage, flaps and hook were then lowered and I radioed "four green". I locked the canopy open as I flew downwind, settling comfortably at 75kt (140km/h). When opposite the ship's "island" I started the final turn. This was where concentration and pulse-rate were at maximum.

The Seafire was now in a nose-high three-point attitude with the speed steady at 65kt (120km/h), about five per cent above its "engine-on" stalling speed. The only way to see was to crane the head as far left as the open cockpit would allow; I could just see the batsman and the port side of the flight deck. My eyes flickered between the batsman and the airspeed indicator to the total exclusion of all else. The flight deck drew ever closer; "bats" signalled minor corrections which I complied with instantly. Concentration, concentration — airspeed and bats — bats and airspeed. Finally the round-down flashed past under the port wing; the batsman gave me the "cut"; I

SEAFIRE F.XV DATA

Powerplant 1 x 1,850 h.p. Rolls-Royce Griffon VI liquid-cooled V12 piston engine driving a 10ft 5in-diameter four-bladed Rotol propeller

Dimensions		
Span	36ft 10in	(11·23m)
Length	32ft 3in	(9·8m)
Height	10ft 8½in	(3·26m)
Wing area	242ft²	(22·48m²)
Weights		
Empty	6,300lb	(2,858kg)
Useful load	8,000lb	(3,269kg)
Performance		
Maximum speed at 36,000ft (11,000m)	392 m.p.h.	(631km/h)
Cruise speed	255 m.p.h.	(410km/h)
Climb to 20,000ft (6,100m)	4,000ft/min	(1,200m/min)
Service ceiling	35,500ft	(10,800m)
Normal range	430 miles	(690km)

levelled the wings, closed the throttle and at the last moment eased the stick back a touch, to land on three points. There was a thump and then a rapid stop as the arrester wire grabbed hold, my shoulder straps digging in at the 2·5g deceleration.

The Seafire rolled back under the tension of the wire, and I let it for a few seconds before applying the brakes. Two flight-deck handlers ran out to free the arrester hook from the wire and clip it back in the up position — thumbs up; a burst of throttle, and I taxied forward over the wire barriers which were immediately raised behind me, ready for the next landing. Following the ballet-like signals from an aircraft handler I was parked as close as possible to other aircraft in the deck park, an area known as Fly One. By the time I vacated the cockpit the next aircraft had landed and was taxying up the deck. The flying operations proceeded like clockwork. With a worked-up ship and squadron, the landing interval was 25–35sec.

. . . AND TAKE-OFF

As there was only an "UP" or "DOWN" choice with the Seafire's flaps, a bit of fiddling was required to provide partial flap for a deck take-off. The *Pilot's Notes* stated that there were spring-loaded chocks fitted to the flaps to provide an 18° down setting but I never saw them. Our fitters had wooden wedges made by the shipwright; after start-up the flaps were lowered, one wedge each side was held in place by the groundcrew; up went the flaps, which were then held open at 18°.

All aircraft on deck had chocks on the wheels, back and front. After run-up the chocks were removed by the handlers and each aircraft taxied on to the centreline in turn. When all clear, the Flight Deck Officer waved his green flag over his head; I opened the throttle and when the flag dropped, I released the brakes and gently applied full throttle. Because of the wind down the flight deck the tail came up quickly, making it easy to hold the aircraft straight with rudder.

After becoming airborne I made a starboard jink to clear my slipstream, before making a 180° turn to port for another approach and landing; when the flaps were lowered the wedges fell out.

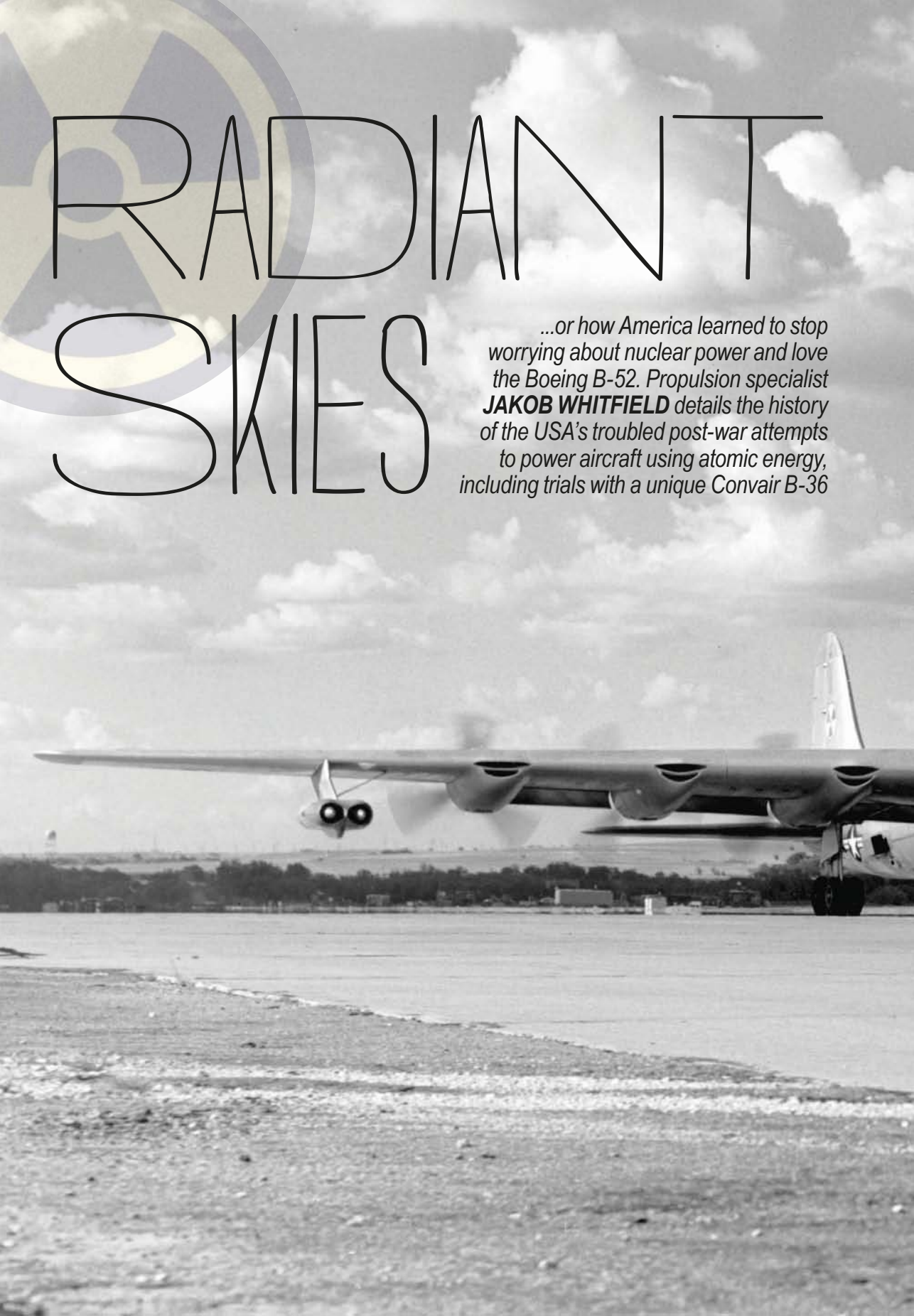
A total of eight good landings was required for qualification on a specific type of aircraft. Later, I assisted in training batsmen and became a qualified DLCO. Ultimately I performed a total of 106 accident-free deck landings in Seafire XV and XVIIs and a total of 550 day and 117 night deck landings during my flying career.

Seafire XVIIs and Fairey Fireflies of the 13th Carrier Air Group aboard* HMS Triumph. *The unit and the ship were the first to deploy in-theatre during the 1950–53 Korean conflict.

PHILIP JARRETT COLLECTION

RADIANT SKIES

...or how America learned to stop worrying about nuclear power and love the Boeing B-52. Propulsion specialist ***JAKOB WHITFIELD*** *details the history of the USA's troubled post-war attempts to power aircraft using atomic energy, including trials with a unique Convair B-36*



EVEN AS THE mushroom cloud faded over Hiroshima in 1945, scientists and engineers were looking for further ways in which atomic power might be harnessed and used. Nuclear fuel contained so much energy that it seemed to be an ideal power source for an aircraft. Might it be possible to build a bomber able to spend days, weeks, or even months at a time on station as an airborne deterrent?

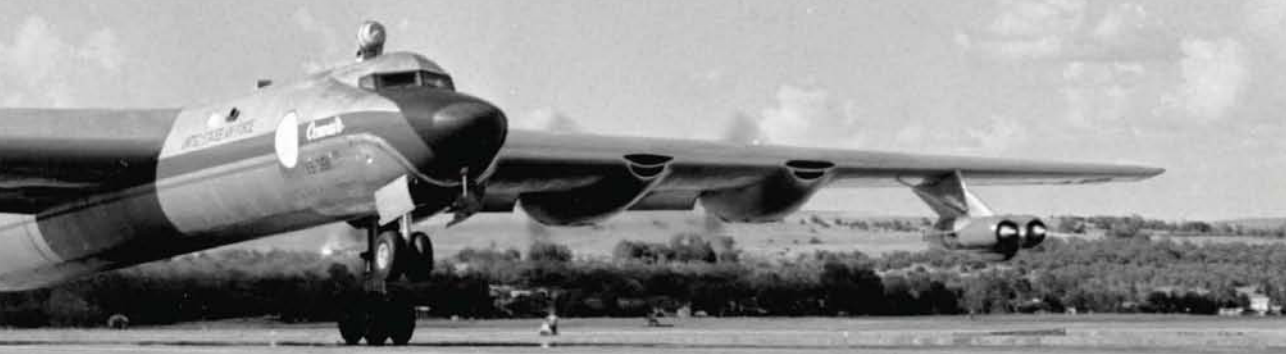
In May 1946 the United States Army Air Forces (USAAF) initiated Project NEPA (Nuclear Energy for the Propulsion of Aircraft), conducting an initial study which concluded that there were three main obstacles to a manned nuclear aircraft:

- materials needed to be developed capable of withstanding the reactor's intense radiation;
- the radiation shielding required might be too heavy for a viable aircraft design;
- the hazards to the public in everyday operation and in case of accidents might be unacceptable.

In 1948 the USA's Atomic Energy Commission (AEC), which had been formed in 1946, performed a similar study. This came to the same conclusions as the earlier report: nuclear-powered flight was possible but would be difficult and expensive to develop — rough time and cost estimates were 15 years and more than $1bn. The report did, however, consider nuclear aircraft propulsion more feasible than nuclear ramjets or nuclear rockets for missile and space propulsion. Encouraged by these recommendations, the AEC set up its own programme.

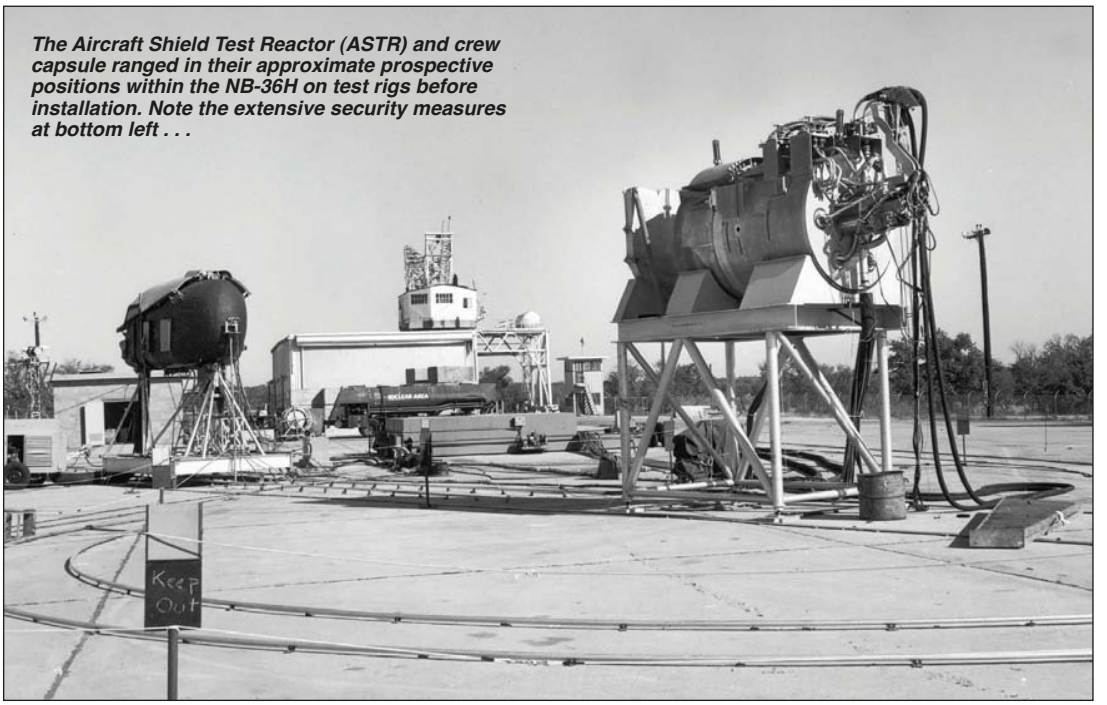
AIRCRAFT NUCLEAR PROPULSION

In 1950 the United States Air Force (USAF, as the USAAF had become in 1947) and the AEC decided to cancel their respective projects and start a joint programme called Aircraft Nuclear Propulsion (ANP). Its aims were to develop



TERRY PANOPALIS COLLECTION

Convair NB-36H 51-5712 was referred to as the Nuclear Test Aircraft (NTA) and made its first flight on July 20, 1955, at Carswell Air Force Base in Texas, in the hands of test pilot Beryl Erickson. The comparatively small nuclear reactor fitted within it was used only to test radioactive shielding and powered no part of the aircraft. Here it thunders into the air with the crew capsule hatch in the up-and-locked position.



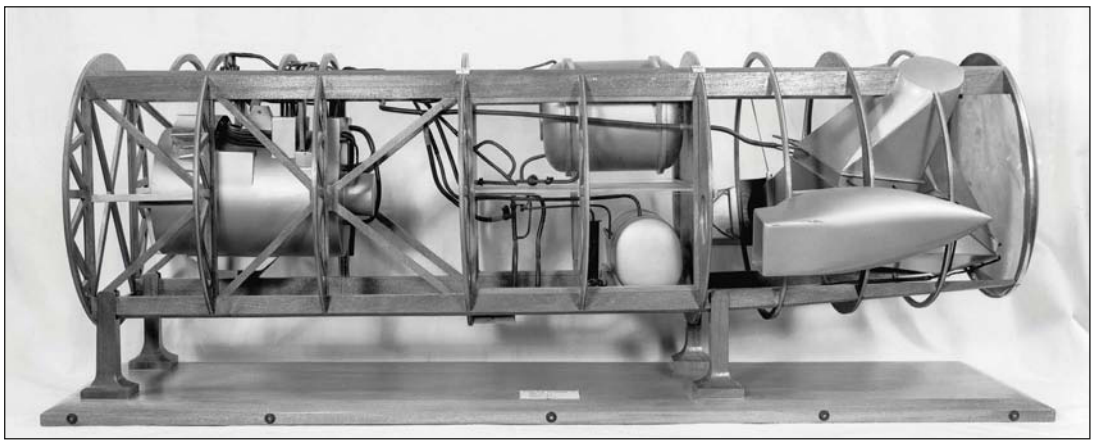
The Aircraft Shield Test Reactor (ASTR) and crew capsule ranged in their approximate prospective positions within the NB-36H on test rigs before installation. Note the extensive security measures at bottom left . . .

TERRY PANOPALIS COLLECTION

reactor materials, shielding, powerplant and aircraft design to the point where a nuclear aircraft could be built. As one wag put it at the time: "It will only have to land every couple of years for the crew to re-enlist!"

The following year it was decided that the programme would be expanded to include a flight test aircraft. Contracts were awarded to General Electric (GE), which would explore the direct-air cycle principle for a nuclear jet engine design, and Pratt & Whitney, which would develop the more complex indirect-air cycle concept (see panel on page 19). Contracts were also issued to Convair and Lockheed for the airframes. Convair planned to modify two of its massive B-36 intercontinental bombers as X-6 nuclear-powered aircraft. Another B-36H was to be modified as the NB-36H "Crusader"; conventionally powered but with a 1MW nuclear reactor in the bomb bay. This Aircraft Shield Test Reactor (ASTR) was intended to test crew shielding and radiation safety.

Of the many challenges facing the engineers, the toughest was the reactor and shielding design. Normal "slow" reactors were easy to design, but incorporated bulky materials to "moderate" or slow down the neutrons to create a sustainable chain reaction. All this bulk meant that a shielded reactor weighed about 200 tons — far too heavy for practical flight. A "fast" reactor used higher-



TERRY PANOPALIS COLLECTION

ABOVE ***A model of the Aircraft Shield Test Reactor installation for the NB-36H. The unit, to be mounted in the massive bomber's capacious aft bomb-bay, was built by Convair and weighed some 35,000lb (15,900kg). It was configured to be removed from the bomb-bay after each test flight for further ground testing and examination.***

Direct- or indirect-cycle?

THE PRINCIPLES BEHIND a nuclear jet engine are quite simple; instead of raising the temperature of the working fluid by burning fuel, the heat produced by a nuclear reactor is used instead. There are two ways of heating the air:

- in an **open or direct-cycle design**, air from the compressor is ducted through the reactor core, cooling it, and is then passed to the turbine. This has the advantage of simplicity, although there are pressure losses in the reactor core and it has the unfortunate side-effect of expelling radioactive particles in the engine exhaust;
- in a **closed or indirect-cycle engine** the reactor is not cooled by the engine airflow, but by a separate coolant with superior heat transfer characteristics. The engine flow is then heated by a heat exchanger on the reactor coolant loop. In many ways this is a more elegant solution than the direct-cycle; it is generally more efficient owing to better heat transfer. The engines may also be located further away from the core and it does not release radioactivity into the atmosphere. Conversely, with all the associated coolant piping, it is significantly more complex than the direct-cycle design. **JW**

speed neutrons and could be much smaller, weighing in at maybe 50 tons, but the temperatures inside were much higher, at over 1,000°C — so high that new materials would be needed if the reactor were not simply to melt. In this respect the indirect-cycle design had an advantage, as the more efficient heat transfer allowed for a less powerful reactor, but the added weight of the heat exchanger and coolant piping negated some of the weight gains.

Given the weight limits on the reactor, there was no way to encase it to prevent loss of containment in a crash. The USAF had concluded that fallout would be relatively localised, with radioactivity being concentrated by the reactor itself and by any fuel rods that broke free. This overlooked the possibility of "roll-up", an effect identified in 1950. As the reactor was so heavy, in a crash it would almost certainly break free from the aircraft structure and roll along the ground. In doing so, the heavy shielding might compress the core to criticality, leading at best to meltdown and at worst to a low-yield nuclear explosion.

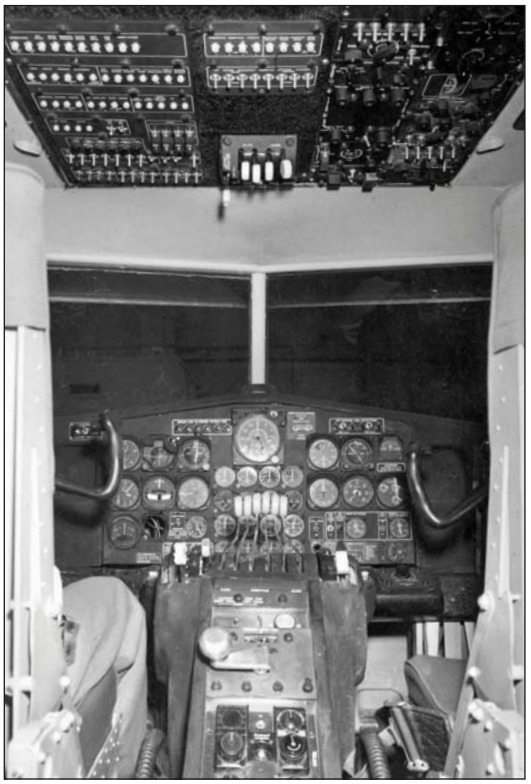
BUILDING A SHIELD

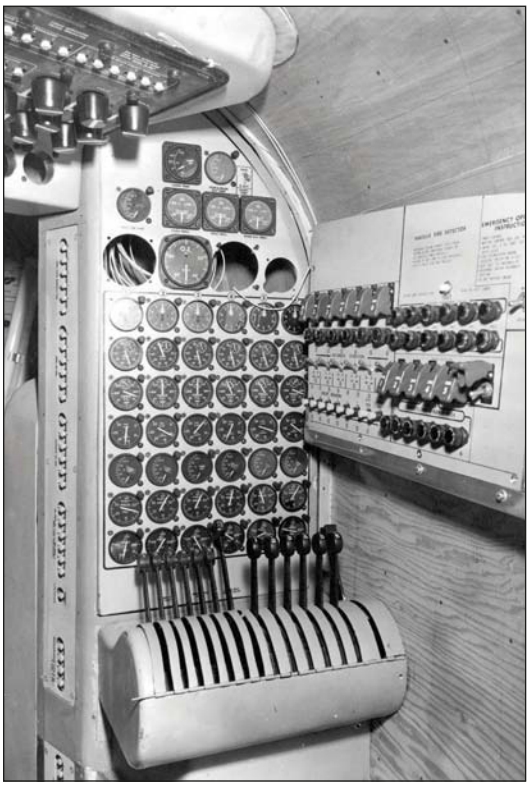
The shielding fitted to the NB-36H was of the divided-shadow type. Instead of placing all the shielding around the reactor, it was divided between the reactor and the crew compartment. The reactor was placed at the rear of the fuselage,

ABOVE LEFT ***The fully pressurised lead-lined crew capsule for the NB-36H weighed some 11 tons. Note the panels installed on the side of the capsule with connection ports for the various control, electrical and hydraulic systems.***

BELOW ***The unique role of the NB-36H called for unique ground support vehicles — the tracked vehicle on the left was a heavily shielded crane for the emergency removal of the reactor and the tug on the right was also shielded.***

TERRY PANOPALIS COLLECTION x 2





VIA AUTHOR x 2

ABOVE ***A pair of rare photographs of the interior of the NB-36H's capsule, including a view of the cockpit on the left and the flight engineer's station on the right. The capsule was so heavily insulated that the crew reported that the combined racket of six R-4360 piston engines plus four J47 jets at full pelt was barely audible during take-off.***

and the 11-ton lead-shielded crew compartment was located in the aircraft's nose. Where possible, equipment (which generally had higher radiation tolerances than the crew) was placed outside the shield, reducing the shield's size and weight, and producing a shielding effect of its own.

The bulk of the shielding was placed between the crew compartment and the reactor, putting the crew in the reactor core's radiation shadow, although scattering from the aircraft structure and the air meant that the crew compartment still needed some shielding. There was also a trade-off in crew location; moving them further away from the reactor reduced shielding requirements but increased structure weight, so at a certain point there was no benefit to moving them further away.

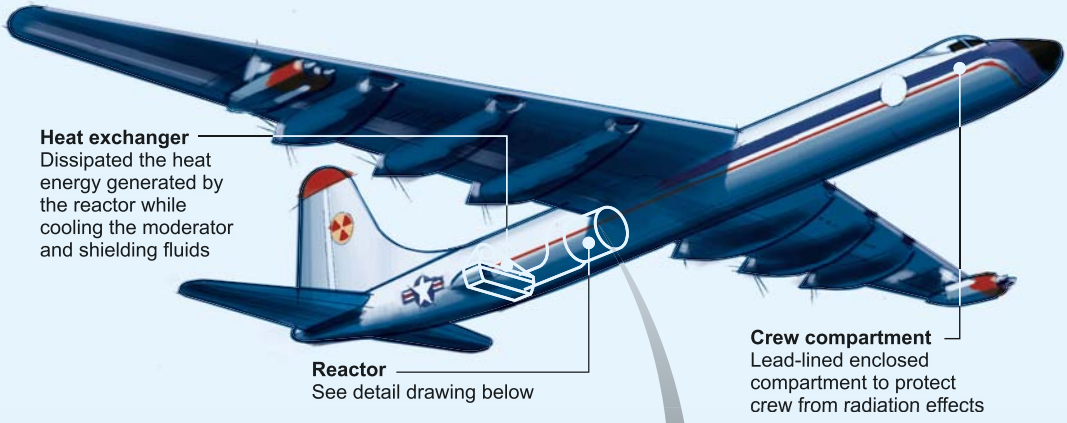
Safe radiation levels were disputed, especially as one of the easiest ways to increase performance was to reduce the amount of shielding. Some bizarre suggestions for increasing radiation tolerance were made, such as choosing crews from men who had already fathered families and had no desire for more offspring, or doing most of the training on simulators and limiting flight time to 2hr of familiarisation and one operational mission! Given that one of the attractions of the nuclear-powered aircraft was its long endurance — with the associated long radiation exposure — it is surprising that relatively little attention was devoted to this subject; then again, experimental radiation tolerance testing could not ethically be performed on humans. The USAF did test other human factors, building a crew compartment simulator in which all the physical and psychological aspects of a five-day mission were evaluated, including calories consumed (from an all-American menu; chicken and gravy and peach pie) and number of bowel evacuations made.

In 1953 the new Eisenhower administration wanted to reduce the USA's defence budget, and the ANP was a prime target. Secretary of Defense Charles E. Wilson, who was under pressure to cancel the project for budgetary reasons, left commentators in no doubt as to how he felt about the NB-36H project, describing it as a "shitepoke . . . a great big bird that flies over the marshes, doesn't have much body or speed to it or anything," he chuckled, "but it can fly".

The planned X-6 was in no way a militarily useful aircraft, and was therefore cancelled. The NB-36H was far enough advanced that it was spared, however, and made 47 test flights between 1955 and 1957 before it was finally

Nuclear-powered flight: step 1, the NB-36H

A standard B-36H modified by Convair, the NB-36H flew 47 times. The working nuclear reactor on board did not power the aircraft, but was used to test contamination levels, shielding requirements and other practicalities of airborne nuclear power

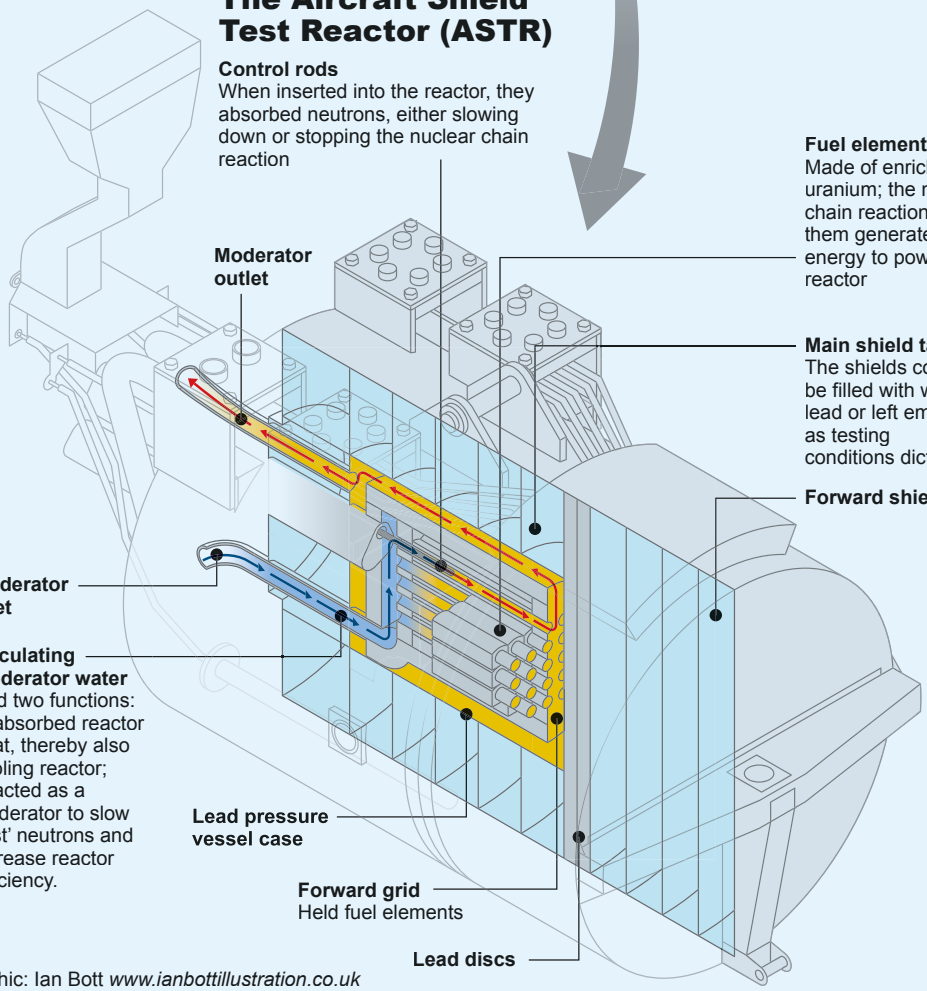


Heat exchanger
Dissipated the heat energy generated by the reactor while cooling the moderator and shielding fluids

Reactor
See detail drawing below

Crew compartment
Lead-lined enclosed compartment to protect crew from radiation effects

The Aircraft Shield Test Reactor (ASTR)



Control rods
When inserted into the reactor, they absorbed neutrons, either slowing down or stopping the nuclear chain reaction

Fuel elements
Made of enriched uranium; the nuclear chain reaction within them generated the energy to power the reactor

Moderator outlet

Main shield tanks
The shields could be filled with water, lead or left empty as testing conditions dictated

Forward shield

Moderator inlet

Circulating moderator water
Had two functions:
1. absorbed reactor heat, thereby also cooling reactor;
2. acted as a moderator to slow 'fast' neutrons and increase reactor efficiency.

Lead pressure vessel case

Forward grid
Held fuel elements

Lead discs

Graphic: Ian Bott *www.ianbottillustration.co.uk*

The NB-36H, with the distinctive radioactive warning symbol on the fin, during one of the 47 test flights it made during its successful test programme. The first of these with a fully functioning ASTR was made on September 17, 1955, and the last was completed in March 1957.

AUTHOR'S COLLECTION

scrapped. On every flight it was accompanied by Boeing B-50 and Douglas C-47 chase aircraft loaded with paratroopers and parachute medics. In case of a crash these were to parachute down, secure the crash site, and render aid where possible. This knowledge was probably cold comfort to the NB-36H crew as they flew along, peering out of their 1ft-thick portholes.

A WHITE ELEPHANT?

Despite the cancellation, ANP was kept going, barely, with USAF funding. It concentrated on engine and reactor development, to which the AEC also contributed. In 1954, the USAF tried for an aircraft again, issuing a specification for a subsonic bomber with supersonic "dash" capability. In 1956 this programme was cancelled.

By now GE had run Heat Transfer Reactor Experiment No 1 (HTRE-1), which consisted of an air-cooled reactor, shielding, two X-39 engines (derivatives of GE's proven J47 jet engine) and associated ducting, controls, and instrumentation. The reactor core was designed to be upgraded as higher-performance versions were developed. The shielding for HTRE-1 was too heavy for it to have been flyable, but by 1957 the higher-performance and lighter HTRE-2 and 32MW HTRE-3 had been tested. The last-named was light enough and produced enough thrust to propel an aircraft, in theory, at 460 m.p.h. (740km/h) for 30,000 miles (48,280km). Although the range was impressive, the speed wasn't exactly sparkling, and there were problems with the release of radioactivity from the open-cycle design; indeed, in 1958 a momentary overload of the HTRE-3 reactor released enough radioactive material to contaminate 1,500 acres (6km²).

The American government would probably have cancelled ANP but for the Soviet Union's Sputnik 1 launch in October 1957. As Congress and the Senate grasped at the straw of a nuclear aircraft that could take the Cold War to the Russians, it was decided to attempt a "Fly Early" project, which would aim for a flyable aircraft in just three years. In 1959, however, with the Fly Early concept no further advanced, the USAF proposed a more militarily useful aircraft — the CAMAL (**C**ontinuously **A**irborne **M**issile-Launcher **A**nd **L**ow-level) weapons system. The idea was that a nuclear-powered aircraft could patrol outside an enemy's airspace for extended periods. In the event of an attack, it could launch stand-off missiles and follow up with low-level attacks on hardened targets. However, with the advent of in-flight refuelling, the then-recently introduced conventionally-powered Boeing B-52 Stratofortress was capable of reaching any target in the Soviet Union. For the cost of ANP to date the Pentagon could have bought some 1,200 B-52s. Furthermore, America's first generation of intercontinental ballistic missiles (ICBMs) were finally overcoming their development troubles and were about to enter service. The Pentagon's Director of Research & Engineering, Dr Herbert York, cancelled CAMAL, insisting that ANP concentrate on the fundamental research that was still needed, especially on reactor materials. In his view, the proposed projects would divert funds from much-needed basic research and would inevitably end in failure.

Such ill-will was in good supply by the end of 1958, the USA's Joint Congressional Committee on Atomic Energy running short on patience. "We find this an almost incredible situation,"

Nuclear-powered flight: step 2, the X-6

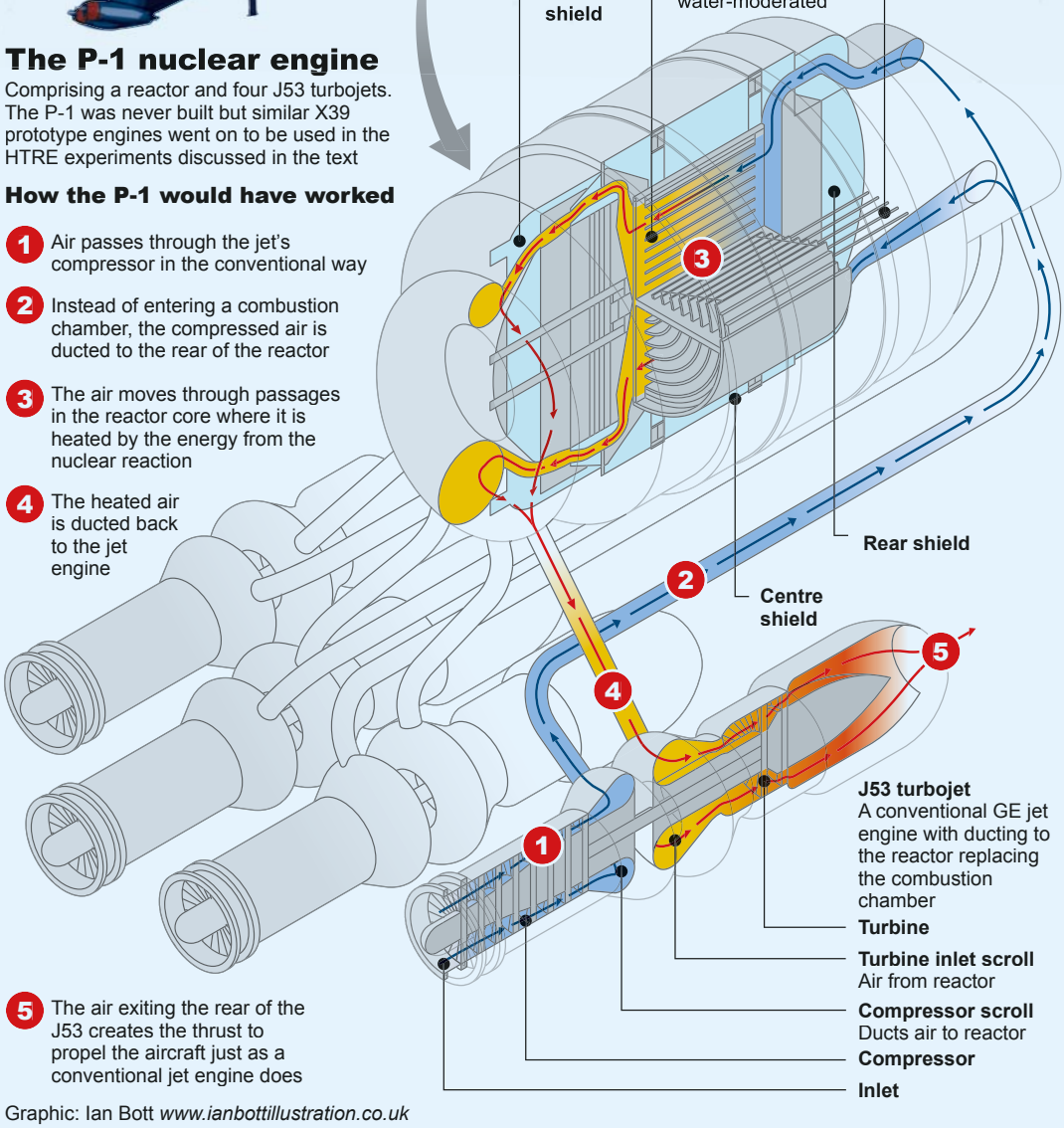
The result of a USAF contract, two modified B-36s, redesignated X-6, would have been powered by a nuclear engine, the P-1, had the latter not been cancelled before construction

The P-1 nuclear engine

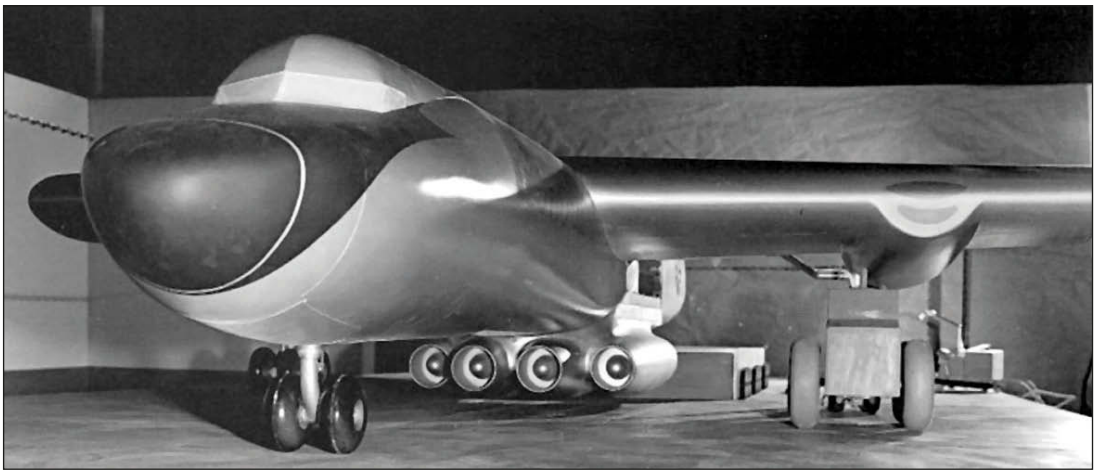
Comprising a reactor and four J53 turbojets. The P-1 was never built but similar X39 prototype engines went on to be used in the HTRE experiments discussed in the text

How the P-1 would have worked

1. Air passes through the jet's compressor in the conventional way
2. Instead of entering a combustion chamber, the compressed air is ducted to the rear of the reactor
3. The air moves through passages in the reactor core where it is heated by the energy from the nuclear reaction
4. The heated air is ducted back to the jet engine
5. The air exiting the rear of the J53 creates the thrust to propel the aircraft just as a conventional jet engine does

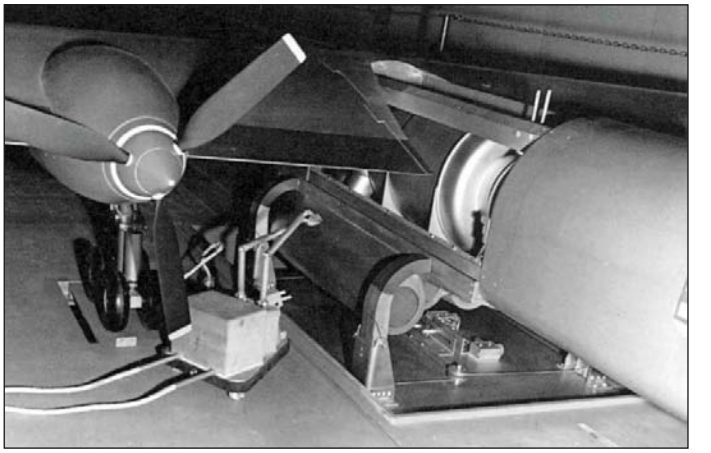


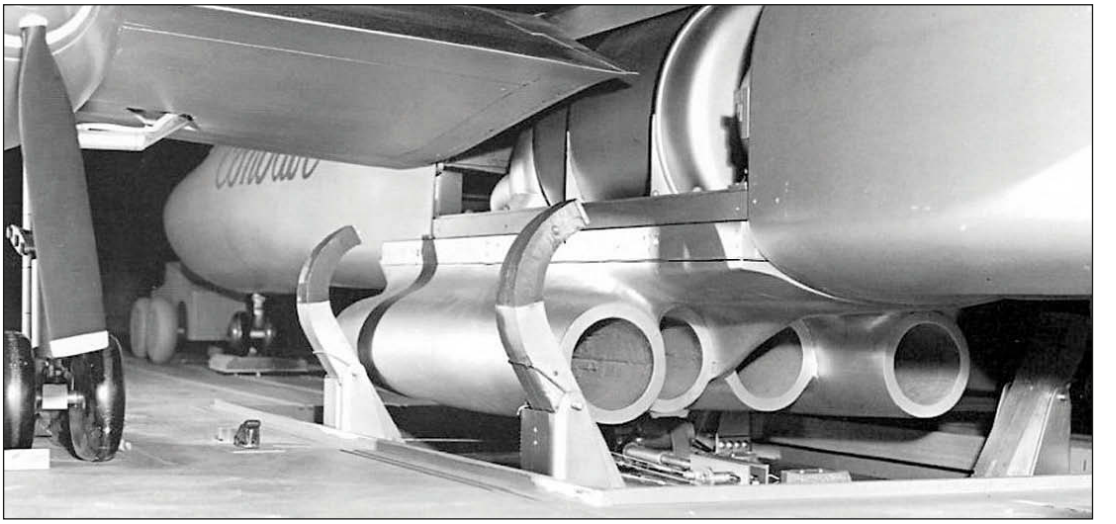
Graphic: Ian Bott *www.ianbottillustration.co.uk*



ABOVE ***Convair constructed a large model of the proposed X-6 to demonstrate the various aspects of ground-handling that would be required. This front view of the model shows the bank of four J53 turbojets that would make up the P-1 powerplant, the reactor being given the designation R-1. Note the flattening of the fuselage as it fairs into the powerplant/reactor bay.***

RIGHT ***As this photograph of a specially-designed handling robot shows, it was intended that all ground-based activities involving the X-6 would be dealt with remotely, as the potential radiation hazards were deemed to be significant. A proposal to use the jet-powered Convair YB-60 was also mooted, but rejected.***





AUTHOR'S COLLECTION x 3

ABOVE ***Another view of the model, looking forward from the rear fuselage. Note the staggered arrangement of the four J53s, in which the two inner engines are placed further forward than the outer pair. The X-6 would also have required a special pit to have been built for the installation and removal of the 14-ton P-1 nuclear powerplant.***

reported the Committee. "The program [sic] still has no firm set of objectives. No decision has been made regarding actual nuclear flight and no target dates have been set for such flight."

FINAL MELTDOWN

Following the November 1960 Presidential election Eisenhower decided to let the incoming Democratic administration decide the programme's future. His frustration with the continuing congressional and military support of what he saw as a white elephant contributed to his final presidential speech in January 1961, in which he famously referred to "the Military-Industrial Complex". On March 26, 1961, President John F. Kennedy finally pulled the plug on ANP, which was still no closer to a workable aircraft. The final project report stated that the three major obstacles to a practical nuclear aircraft still remained. Echoing the 1946 report, these were reactor materials, reactor shielding and crew and public safety.

In hindsight, what is surprising is that the programme survived as long as it did. It was ruinously expensive and never even came close to producing a test aircraft. Whether this was ever a viable goal is open to question. As the Project Director stated in 1954, "a manned nuclear aircraft poses the most difficult engineering job yet attempted within this century". The problems were never solved. On many occasions only the lobbying of its industrial, military and political supporters saved the programme.

Always responding to the latest idea or "red scare", the stop-start nature of ANP meant that little fundamental research was completed, although the programme did make advances in high-temperature reactor materials. As a result it produced remarkably little of enduring value for the 15 years and $1bn spent. Even its most fervent advocates were forced to admit the shortcomings of the project. Illinois Congressman Mel Price, an ardent and outspoken backer of the nuclear-powered aircraft concept, had to admit his disappointment in ANP in the wake of its demise:

"The [ANP] records are filled with stories of divided authority, vacillating budgets, withheld funds, technical reviews, changed objectives, transferred personnel — the list goes on — it is a story of a good project being killed by indecision and bungling".

Rivals: the nuclear Navy

IT MUST HAVE been intensely frustrating for the ANP team to watch the building of the USA's "Nuclear Navy". *USS Nautilus*, America's first nuclear-powered submarine, was launched in January 1954 under the hard-driving and ruthless leadership of Captain (later Admiral) Hyman G. Rickover (**ABOVE**).

Compared to ANP, Rickover had both technical and organisational advantages; he was a master of bureaucratic in-fighting and had much tighter control over his project team. Technically, it was far easier to float shielding than to fly it. The *Nautilus* could use a "slow" pressurised water reactor that was safe and reliable; an aircraft reactor needed to be ½₀th the size and would run five times hotter.

USS Nautilus, ***the world's first operational nuclear-powered submarine, with Manhattan as a backdrop. The*** **Nautilus** ***was launched on January 21, 1954 and went on to set numerous records for submarines.***

The Alpha Archive is a California-based privately-owned collection of rare and previously unpublished photographs of classic American civil and military aircraft

LEFT *The US Navy was the first American military service to acquire a Ford Tri-Motor. The first XJR-1 (serial A7526) was the fourth Tri-Motor built and made its first flight on January 29, 1927, before it was delivered to the Navy that March. After it was damaged by a tornado on November 18, 1927, repairs were made and the aircraft was operated until April 1930, when it was scrapped at Philadelphia.*

RIGHT *The US Army took delivery of its first Tri-Motor ten months after the Navy received its first example. Tri-Motor production for the Army comprised one C-3, seven C-3As, one C-4 and four C-4As. The C-3As were redesignated C-9s upon delivery. This C-9, 29-224, first flew on June 18, 1929, and is seen here at Floyd Bennett Field in April 1931. Note the insignia of the Air Corps Technical School at Chanute Field on the fuselage sides. The aircraft was surveyed at the San Antonio Air Depot on November 1, 1934, as having accrued 1,794hr of flying time.*

LEFT *The Navy acquired nine Tri-Motors: one XJR-1; two JR-2s; three JR-3s; one RR-4 and two RR-5s. In January 1935 the RR-4, A8840, was flown to the Naval Aircraft Factory for overhaul, after which it was handed over to the US Marine Corps at Quantico, Virginia. Overly keen use of the brakes put the machine on its nose on March 1, but it was soon repaired and went on to fly with VJ-6M. The machine had a short service life, being stricken from service on May 29, 1937.*

american classics

US MILITARY FORD TRI-MOTORS

from the alpha archive

ABOVE ***Ford JR-3 A8598 made its first flight on December 27, 1929, and was transferred directly to the Marines from a Navy order. The Tri-Motor stayed at the factory, where it is seen here, until April 30, 1930, when it was flown to Nicaragua, where the Corps was fighting rebel forces. On August 4, 1930, the aircraft suffered a landing accident and caught fire at Ocotal, but the pilot escaped from the burning machine with no injuries.***

ABOVE ***US Navy Ford RR-5 9206 is seen here at Floyd Bennett Field, New York, in 1935. This Tri-Motor was delivered to Naval Air Station (NAS) Anacostia on February 17, 1932, before moving on to NAS Pensacola in December 1934. In service, the Fords were used for a variety of duties, from transporting VIPs to carrying cargo between bases. As may be seen, markings were minimal. This aircraft flew some 2,784 hours, making it the most flown Ford in the Navy/Marine fleet. The aircraft was withdrawn in July 1940 with the notation "worn out".***

ABOVE ***With its spacious interior the ubiquitous Tri-Motor was ideal for testing the bulky airborne radio equipment of the day. Two large antennae are clearly visible atop the fuselage of this C-9, which has markings that leave no doubt as to its purpose, alongside Wright Field's distinctive "arrow" marking. Early tests on radio-controlling another aircraft were performed at Wright Field, but the concept would not be perfected until the late 1930s. The C-9 variant replaced the C-3A's 235 h.p. Wright R-790-3 engines with a trio of 300 h.p. Wright R-975-1s.***

Happiness is . . . Vectored Thrust

In the first half of a two-part section on Hawker Siddeley's unique civil-registered two-seat Harrier demonstrator G-VTOL **CHRIS FARARA** examines a career with more than its fair share of ups and downs. On page 42 test pilot **JOHN FARLEY** concludes with a description of flying the hardworking Harrier in India in 1972

Hawker Siddeley Harrier Mk 52 demonstrator G-VTOL in the distinctive and stylish — although unfortunately rather short-lived — initial red, white and blue colour scheme designed by John Fozard, hovering at Dunsfold shortly after its first flight in September 1971.
MIKE STROUD

HAWKER SIDDELEY AVIATION (HSA) Kingston's two-seat Harrier Mk 52 demonstrator was a unique variant of the RAF's T.2 trainer, and undertook a great deal of invaluable work throughout its career, as will be detailed in this feature. We should, however, begin with a brief history of the development of the two-seat variant of the aircraft that would gain worldwide fame as the apogee of British aviation engineering and design excellence.

Genesis of the two-seater

Early RAF Harrier experience following the type's entry into service in April 1969 had indicated that a two-seater was required for training and that such a machine would also have to be usable operationally with minimum performance penalty — and of course it would have to be as inexpensive as possible.

As a result, in 1965 an Air Staff Target (AST) was sent to HSA's Assistant Chief Designer (Projects), Ralph Hooper, creator of the P.1127/Harrier series, who produced a general arrangement (GA) drawing. Based on this GA, Jack Simmonds in the Design Office schemed a number of possible layouts. A tandem cockpit was chosen to keep the fuselage shape forward of the intakes as similar as possible to that of the single-seater to avoid changing the airflow ahead of the short, and

Although the Harrier was built entirely with function in mind and was arguably not the most beautiful of aircraft, John Fozard's initial colour scheme for G-VTOL accentuated the jet's unusual lines and even managed to create an impression of elegance.

ALL IMAGES TAH ARCHIVE UNLESS OTHERWISE STATED

hence aerodynamically sensitive, intake ducts. To satisfy the Ministry of Defence's requirement that the instructor's view from the rear cockpit be as good as that from the front, the rear seat was raised. Also, to minimise nose length and centre of gravity (c.g.) forward movement, the cabin-conditioning equipment was repackaged and housed in the rear seat fairing, allowing the cockpit to be moved aft between the intake ducts.

A formal HSA Project Study for this, HS.1174, to satisfy Air Staff Requirement (ASR) 386, was in the processs of being prepared when legendary designer Sir Sydney Camm died in March 1966, making the two-seat Harrier the last Kingston-created aircraft to which his design experience was applied, albeit more by way of criticism and approval than direct contribution.

The two-seat design solution was ingenious and combined minimum change with reasonable appearance — always important to Camm and necessary to gain his approval. The standard Harrier front fuselage was "cut off" aft of the cockpit and moved forward, leaving enough space to insert a plug containing the raised second cockpit. New side-hinged canopies covered each cockpit. To balance the aircraft a "sting" extension, carrying detachable ballast weights, was added to the tail. To restore directional stability, which was degraded by the extra forward side area, the fin was moved aft and mounted on a stub fin to increase its area, and a larger ventral fin was fitted. Apart from duplicated controls and systems for the second pilot, almost everything else was unchanged. In time of war the second seat and detachable tail ballast could be removed, reducing the weight penalty over the single-seater to only 800lb (363kg). The weapon load capability of the two-seater was the same as the single-seat Harrier GR.1.

Two's up

The first flight of the new variant, made from Dunsfold by Chief Test Pilot Hugh Merewether on April 22, 1969, showed that its handling qualities were very similar to those of the single-seater, although directional stability at

G-VTOL is prepared for another flight at Dunsfold. Two-seat Harriers intended for use only in the training role, essentially non-RAF operators, retained the broader-chord fin as seen here, the RAF retrofitting its two-seaters with a smaller fin for better ground-attack performance.

In September 1971 a reception was held at Dunsfold for the directors and executives of the suppliers which had contributed to the building of G-VTOL. This group photograph shows the guests and their Hawker hosts, notable among the latter being Purchasing Manager Ambrose Barber, third from right in the top row in front of the tailplane, to the right of which is Commercial Manager Colin Chandler. The guests included representatives of Rolls-Royce, Dowty Rotol, Flight Refuelling, GEC Marconi, Hymatic, Vickers Sperry Rand, Smiths Industries, Triplex, Normalair, SARMA (UK) and Fireproof Tanks Ltd among others.

AMBROSE BARBER VIA AUTHOR

ABOVE LEFT ***Dr John W. Fozard joined Sydney Camm's design team at Kingston in 1950, becoming Chief Designer (Harrier) in 1964 and Deputy Chief Engineer three years later.*** **ABOVE RIGHT** ***Test pilot Duncan Simpson greets a foreign naval officer with Ralph Hooper, HSA Executive Director and Chief Engineer, at Dunsfold in 1972.***

high angles of attack was inadequate. This was explored and many fixes were tried, including the placing of vortex generators near the canopy and revised upper intake lip contours, as disturbed airflow from that region was understood to be the cause. However, more fin area was the solution and a taller broader-chord fin was designed under Deputy Chief Engineer John Fozard's supervision. This was initially adopted for the RAF but it degraded the aircraft's ground-attack weapon-aiming characteristics and generated excessively high fin loads in rolling pull-outs. As the RAF intended an operational, as well as training, role for the two-seater, its aircraft were later retrofitted with a smaller fin. The large fin was retained on export two-seaters, however, where the operators intended only a training role for their aircraft.

The smaller fin of the RAF's two-seaters was a slightly taller version of that fitted to the Harrier GR.3 variant in order to accommodate the latter's RWR (radar warning receiver) aerial. It was eventually standardised on all RAF and Royal Navy single- and two-seat Harriers.

A civil jump-jet

The building of a Harrier two-seat demonstrator to attract export orders, designated the Mk 52, was put in hand by HSA at Kingston. Allocated civil registration G-VTOL (for **V**ertical **T**ake-**O**ff and **L**anding) — one of the first off-sequence personalised UK registrations — it was to be funded entirely by HSA. Subcontractors which supplied parts for Harrier production were persuaded by Kingston's Purchasing Manager, Ambrose Barber, to provide equipment free of charge. This was vital as the Hawker Siddeley Board had decreed that there would be no demonstrator unless all the suppliers agreed to back it in this way. Changes from the RAF

The manufacture of G-VTOL depended on the goodwill of numerous firms, including Rolls-Royce, which loaned and provided technical support for a total of six Pegasus 11/Mk 103 engines throughout G-VTOL's career.

MIKE STROUD

Taken sometime during the three-week period G-VTOL was flown in its first colour scheme, this photograph captures the aircraft making a turn over the western perimeter track at Dunsfold. Within a matter of days it would run off the runway during a test flight and be repainted in a desert camouflage scheme for its upcoming promotional tour.

T.2/4 included the fitting of Magnavox ARC 164 UHF and 657R VHF radios, a Collins VHF 20 alternative radio, a Collins 51 RV1 VOR, a Collins DF206 ADF and a Cossor 2720 ATC (air traffic control) transponder. Also fitted were a digital JPT (jet pipe temperature) indicator for clarity, a PRL (pressure ratio limiter) on/off switch to mute its operation at high-altitude airfields to prevent surprise thrust reductions, and a rear cockpit water-injection on/off switch so the company pilot could override any incorrect front cockpit selections. The tail ballast was fixed as the aircraft was to have no operational role. Clearance was extended to permit operations at sea-level air temperatures from -26°C to +45°C. The aircraft was fitted with the large fin throughout its career to retain good handling qualities at high angles of attack.

The new demonstrator was the 12th two-seater and made its first flight (1hr 10min) in the hands of Chief Test Pilot Duncan Simpson on September 16, 1971, to become the world's first jet V/STOL aircraft with a civil Certificate of Airworthiness. This Special Category document, No A.11640, permitted "testing the aircraft; exhibiting the special flight capabilities of the aircraft, demonstration to potential customers and demonstration in flight to properly briefed passengers at the direction of the Commander of the aircraft".

Equipped with airline-standard communications and navigation equipment 'VTOL was ready to fly the airways of the world. It was a striking sight in its patriotic red, white and blue livery designed by John Fozard. The primary purpose of the aircraft was to enable potential customers' pilots and influential officials to experience Harrier flight at first hand under the guidance of a company pilot, and so demonstrate the many outstanding and unique qualities of the type. It would also show that an ordinary suitably experienced pilot could fly it.

Early dramas

The new demonstrator nearly came to a premature end when it overran the 7,000ft (2,100m) Dunsfold runway on Flight 12, just three weeks after its first flight. The last part of this test flight, before a Middle East and India sales tour, was to measure the end speed on a simulated 550ft (168m) flight deck representing the Indian Navy (IN) carrier *Vikrant* by means of a short take-off (STO) hop. The aircraft hopped into the air at the end of the "deck" but the power was reduced too slowly and the touchdown was late and fast. The use of nozzle braking (nozzles forward, full power) was then necessary, but as this might cause foreign object ingestion damage to the engine the pilot, Tony Hawkes, chose to rely on wheel brakes with nozzles forward but without full power. The aircraft ran off the end of the runway on to the grass overshoot, which, unfortunately, was very slippery and hard owing to a prolonged dry spell, and provided little retardation. The aircraft continued down a steep slope into trees, suffering extensive damage (see page 34).

The aircraft was ready again by May 1972, repainted in desert camouflage, and set off in June, with Tony Hawkes and John Farley, on the delayed sales tour, managed by Kingston marketing executive Johnnie Johnson assisted

THE VIEW FROM THE BACK SEAT by Mike Craddock

THE DATE WAS September 16, 1971, and it was to be G-VTOL's first flight. The aircraft positively gleamed in the sun at Dunsfold, magnificent in its unusual red, white and blue colour scheme. All the system checks and engine runs had been completed and it was time to get some pictures for publicity. On the ground the company photographer was present with senior managers, technicians and fire crews; in the air the photo-support aircraft was ready. Duncan Simpson would fly the aircraft and I would be the observer in the back seat. We strapped in, started up and took off and, after a few checks, climbed to the rendezvous point for the photographs. At the agreed time a company Hawker Siddeley 125 appeared beside us, and we could see the photographers watching us through their lenses. Duncan arranged suitable manœuvres with the 125 pilot, so we banked and turned around the 125, got some spectacular close-ups [as seen **ABOVE**] and, when all were satisfied, broke off and returned to Dunsfold; a successful flight with some great pictures obtained.

Into the woods

A few weeks later I was called to another sortie in G-VTOL and this time Tony Hawkes was to be the pilot. Tony was meticulous and could fit tests into flights in rapid succession so I knew it would be a busy afternoon! We did a short take-off (STO) and then performed navigation and radio checks before landing at Thorney Island. We returned to Dunsfold for a vertical take-off, hover and short landing. We then commenced another STO but a few seconds after lift-off returned suddenly to the ground (subsequently Tony explained that he had belatedly decided that the fuel remaining was too marginal for another full circuit). By then we were doing about 120kt (138 m.p.h.— 222km/h) and it became clear that we were too far down the runway to stop in the remaining distance. Tony was using wheel brakes and had the nozzles in the braking position, but our rate of deceleration was unsatisfactory. Shortly we reached the end of the concrete and ran on to the grass overshoot. Wheel braking became ineffective and we were aware that we were closing fast on a wood at the end of the grass and were unlikely to stop before reaching it. "Cover up!" said Tony at the last moment as we plunged down a slope into the woodland. I braced myself and amidst a flurry of thrashing branches and flying leaves we came to a sudden halt pointing downhill (as seen **BELOW LEFT**).

Fortunately there was no fire, Tony turned off the main systems and we started to unstrap. My canopy opened but Tony's jammed owing to fuselage distortion and he was forced to use the miniature detonating cord to shatter the canopy so that he could climb out. His shoulders were peppered with debris as a result and he needed treatment for this afterwards. By the time we were out the fire truck and an ancient ambulance had arrived at the scene with several worried people, including Duncan and various managers. A decision was made that we needed medical checks and should both go in the ambulance to Surrey County Hospital. There followed a fast 20min journey, with the bell ringing continuously, to the casualty department where we both had to stand in the waiting area in full flying suits and harnesses, carrying our helmets. We had a few funny looks and it was certainly an unusual event for the doctors! We were discharged that evening and only Tony had to suffer further treatment for the blast effect on his shoulders.

CHRIS FARARA COLLECTION

That was the last time I flew in G-VTOL and I subsequently left Dunsfold and took up a different career, but I am regularly reunited with it at Brooklands Museum.

ABOVE ***Following its mishap at Dunsfold in October 1971 G-VTOL was repaired and made ready for a sales tour of the Middle East and India, for which it was painted in a new desert camouflage colour scheme with pale blue undersurfaces. It is seen here hovering during tests at Dunsfold before setting off on the first leg of the tour.***

by his colleague Robbie Roberts. Salesmen and a five-man Dunsfold maintenance team travelled in a Hawker Siddeley 748. Sales promotion stops were made at Tehran in Iran and Kuwait before setting off for Bombay and Cochin in India, hampered by the monsoon weather activity.

From the Cochin base the aircraft was flown aboard the carrier *INS Vikrant* by John Farley (see pages 42–47). In two days he flew 17 sorties from the ship plus two return trips from Cochin to the *Vikrant*. The first day's operations were to establish handling and performance data relevant to the ship and local conditions (a Dunsfold flight test team led by Eric Crabbe had flown out) and the second day was devoted to flying Indian Navy pilots. Next, interrupted by the heavy monsoon rains, G-VTOL left Cochin, with an IN officer aboard, for Goa and thence to Delhi, demonstrating a low-level mission as requested by the IN. In Delhi there was more IN and Indian Air Force pilot familiarisations with Hawkes and Dunsfold test pilot Andy Jones, who had replaced Farley in the team.

From Delhi G-VTOL flew via Bombay and Masirah to Abu Dhabi, one of the Emirates on the Persian Gulf. A demonstration to the Ruler and Minister of Defence had been organised to take place at a semi-prepared strip near Al Ain. During a hover in front of the assembled VIPs a cloud of dust engulfed the aircraft and, instead of climbing away, Hawkes, with no visual cues, reversed into the cloud, lost height and hit the ground with a thud, breaking an outrigger and the noseleg . . . end of tour. The machine was flown back to Dunsfold in a Canadair CL-44 Guppy to be repaired, and John Farley returned to the Middle East and demonstrated a GR.1 to show that there was nothing fundamentally wrong with the aircraft. Harriers were never sold in that region but the Indian Navy did eventually became an important customer for the Sea Harrier. Previously it had operated Hawker Sea Hawks and eventually would acquire Hawk trainers, another Kingston type. Difficulties in obtaining liquid oxygen during the tour led to the later substitution of a gaseous system.

Steady work

The two-seat demonstrator flew again in February 1973, performed a great deal of pilot familiarisation work, demonstrated at Dartmouth, Yeovilton, Wildenrath and Staverton, and made the first of many appearances at the Paris Air Salon before being air-freighted to Rio where it was assembled and air tested in preparation for an extensive tour of South America. The tour was managed by

Crunch! Groundcrew take precautionary measures after G-VTOL comes to grief during a demonstration in Abu Dhabi on July 16, 1972. Damage was confined to the starboard wingtip and outrigger, the noseleg and a twisted nose.

Flying down to Rio — G-VTOL pays a visit to the 125ft (38m)-high* Cristo Redentor *statue on the peak of Corcovado mountain in Rio de Janeiro, Brazil, during the 1973 South American sales tour.

ABOVE ***Managed by John Parker (furthest left) the 1973 South American sales tour took in Brazil, Paraguay, Bolivia, Peru (which had acquired Hunters in the mid-1950s) and Ecuador. Also on hand was John Glasscock, HSA Kingston General Manager (centre photograph, in suit) and the flying was undertaken by John Farley (above right, in flying overalls) and Don Riches. Although impressed with the Harrier, none of the nations on the tour acquired it.***

John Parker, Kingston's South American regional marketing executive, and flown by John Farley and another Dunsfold test pilot, Don Riches. The tour ran from September 12 until October 19 and consisted of 62 flights of demonstrations, pilot familiarisations and carrier operations. The route started in Brazil at Galeão (Rio) and moved on to San Jose (São Paulo), Santa Cruz and San Pedro before returning to Galeão; then on to Asunçion in Paraguay, Cochabamba in Bolivia, Lima in Peru and on to Ecuador to visit Guayaquil and Quito before returning to Peru to visit Las Palmas and conclude the tour at Lima, where the aircraft was broken down for return to Dunsfold in a CL-44 Guppy. The São Paulo Air Show was attended and the Brazilian Navy carrier, *Minas Gerais*, was visited from Santa Cruz. In spite of generating great technical interest in the Harrier, the tour resulted in no orders. Spectacular publicity photographs were obtained, however, including G-VTOL flying past the Corcovado statue of Christ at Rio and hovering in front of the enormous airship hangar at Santa Cruz.

G-VTOL goes to sea again

Next, in November, a group of French naval aviators was familiarised in preparation for trials on the French Navy carrier *Foch*, with John Farley at the controls again. Later that month G-VTOL flew from *HMS Bulwark*. In January 1974 it was off to Algeria, in May it was sent to Italy and in September the aircraft attended the SBAC Display at Farnborough where the BBC's Raymond Baxter memorably broadcasted from the back seat during a Farley demonstration.

Throughout G-VTOL's flying career UK demonstrations and pilot familiarisations were interspersed with more exciting overseas and

The hardworking G-VTOL aboard* HMS Hermes *during service release trials in February 1977. Trials at sea gathered pace during 1977–78 in preparation for the introduction of the Sea Harrier, the first of which, XZ450, first flew in August 1978.

development work. In 1975 the aircraft flew from *HMS Engadine*, *HMS Bulwark* and *HMS Fearless*, attended the Paris Air Salon and trained McDonnell-Douglas test pilots Charlie Plummer and Bill Lowe in the art of jet V/STOL flying.

1976 was a year of UK-based "demos and famils" with a smoke system which was ultimately deemed unsuccessful, as the smoke hid the aircraft. In 1977 'VTOL flew from *HMS Hermes* on Harrier service release trials and helped celebrate the launching of *HMS Invincible*, the Sea Harrier's future home, with a display over Barrow-in-Furness. It also demonstrated from the Australian carrier *HMAS Melbourne*.

That October the aircraft participated in ski-jump trials then in progress at the Royal Aircraft Establishment at Bedford, with the ramp set at 9°. In 1978 the angle was increased through 15–17½° and that September the first public ski-jump (see panel on page 38) demonstrations were flown at the SBAC Air Display at Farnborough on a ramp constructed by the Royal Engineers from Fairey Engineering medium girder bridge components. This proved to be the highlight of the show. For these trials extra nozzle-lever STO stop positions at 20° and 35° were fitted as were stronger main and nose undercarriage legs. In November there were more Controller Aircraft (CA) Release trials aboard *HMS Hermes* as the latter had been fitted with a 12½° ski-jump. In 1979 Bedford ski-jump trials were completed with the ramp set to what seemed an impossibly large exit angle of 20°, but the Harrier still flew easily and effortlessly away. The Royal Engineers erected their medium girder

With roundel applied on the aft fuselage, G-VTOL points towards the ski-jump erected at Farnborough by the Royal Engineers. The aircraft would later also have military serial ZA250 applied, to allow the carriage of trials weapons, which was not permitted on civil aircraft.

THE "SKI JUMP"

THE "SKI JUMP", an upward-curving ramp fitted to the bow end of an aircraft carrier's deck, was proposed by Lt-Cdr Doug Taylor of the Royal Navy in 1973. It was in fact an ancient and familiar notion — that of increasing the time of flight of a projected body by imparting an initial upward momentum. Taylor perceived that, given an aircraft having enough thrust to accelerate in an initial upward trajectory, the increased time of flight would enable the vehicle to be launched at a lower speed and with a poorer lift-to-weight ratio. Airspeed would build throughout the part-ballistic trajectory until the aircraft was able to fly under its own power. As a result, deck runs could be much reduced and fuel and weapon loads increased. In addition there was a safety benefit as the aircraft always left the deck end in an upward trajectory, giving the pilot more time to eject in an emergency.

Taylor's studies were given qualified support by HSA engineers at Kingston, with performance engineer Trevor Jordan and structural dynamics engineer Doug Thorby refining Taylor's ideas until, in mid-1974, HSA effectively espoused the concept. The active support of a few far-sighted men in the Ministry of Defence and Royal Navy led to small study contracts for HSA at Kingston, which by late 1975, was publicly championing the concept. An adjustable test ramp was built at RAE Bedford and the idea would ultimately be applied to RN carriers.

bridge ski-jump at Le Bourget for the Paris Air Salon in June and 'VTOL stole the show again. For marketing reasons the desert camouflage was replaced by a grey-and-white scheme which matched Hawk demonstrator G-HAWK/ZA101, and the military serial ZA250 was added. The year finished with another visit to *HMS Hermes*.

Skyhook and retirement

1980 was a quiet year for G-VTOL, with servicing being undertaken by HSA at Holme-on-Spalding Moor, but the aircraft did appear at the SBAC Display at Farnborough that September. It was also evaluated by the Brazilian Air Force. During 1981–82 the aircraft was flown by Indonesian, Chilean, Japanese and Indian pilots and during 1982–83 large numbers of Indian Navy pilots were fully trained flying from Dunsfold, RNAS Yeovilton and *HMS Hermes* in preparation for India's receipt of Sea Harriers. This was contracted work helping G-VTOL to pay its way. Swiss Air Force pilots flew it in 1984 and there was much chase-flying for various Harrier and Hawk development and production programmes.

In 1985 G-VTOL became an integral part of the development of the "Skyhook" concept invented by Dunsfold Chief Test Pilot Heinz Frick for small ship operations. A Harrier hovering alongside would dock with a ship-mounted space-stabilised crane, then be swung aboard for rearming and refuelling. The replenished aircraft was then ready to be swung overboard

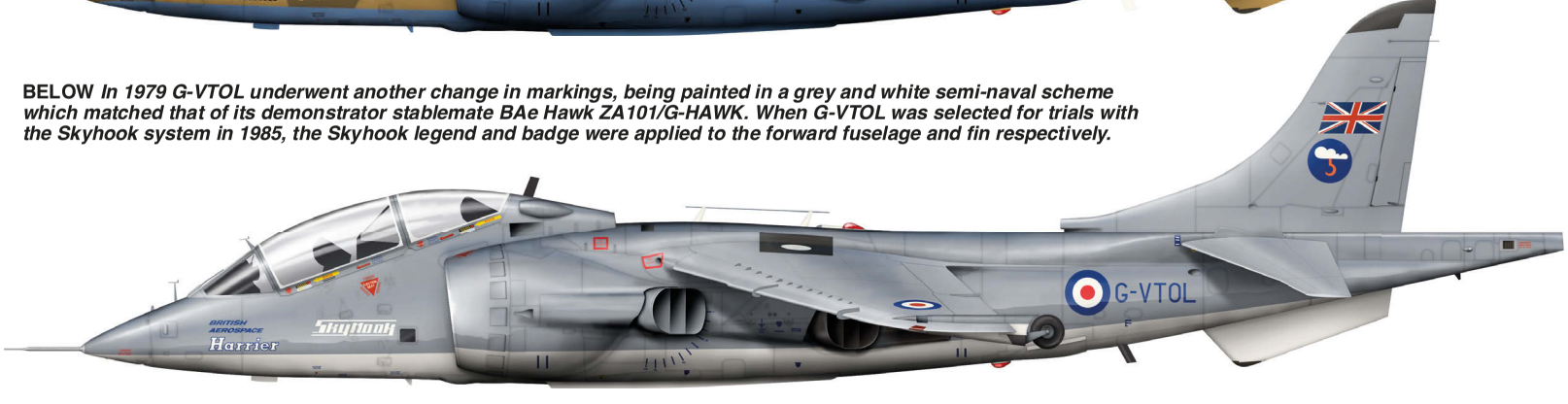
G-VTOL leaps into the air from the variable-angle ski-jump at the Royal Aircraft Establishment at Bedford. The multi-hydraulic-jacked structure at Bedford was an ingenious piece of engineering, capable of rotating 20,000lb (9,000kg) of Harrier moving at speeds of up to 100kt (185km/h); its total cost was reported to be less than £250,000.

ARTWORK BY JUANITA FRANZI / AERO ILLUSTRATIONS © 2013 www.aeroillustrations.com

BELOW *Hawker Siddeley Harrier Mk 52 G-VTOL was originally painted in a patriotic red, white and blue scheme designed by HSA Deputy Chief Engineer John Fozard. It remained in this scheme only a matter of weeks, however, the Harrier running off the runway at Dunsfold just three weeks after its first flight, which had been made on September 16, 1971.*

BELOW *By the time G-VTOL was ready to fly again in May 1972 it had been painted in a two-tone desert camouflage scheme with pale blue undersurfaces, which was more suitable for the upcoming sales tour of India and the Middle East. The "Navy" legend in white on the fin was added for ship trials aboard* **HMS Fearless** *at Greenwich in June 1975.*

BELOW *In 1979 G-VTOL underwent another change in markings, being painted in a grey and white semi-naval scheme which matched that of its demonstrator stablemate BAe Hawk ZA101/G-HAWK. When G-VTOL was selected for trials with the Skyhook system in 1985, the Skyhook legend and badge were applied to the forward fuselage and fin respectively.*



AUTHOR'S COLLECTION

As the marketing emphasis changed, G-VTOL was repainted in a grey and white colour scheme, as seen here in company with BAe Hawk demonstrator ZA101/G-HAWK returning from the 1979 Paris Air Salon.

and released into the hover for transition into its mission. It fell to G-VTOL to prove that a Harrier could be positioned accurately enough for safe and repeatable capture by the crane. Sadly this brilliant idea was not pursued by the Ministry of Defence or British Aerospace (BAe — of which HSA had become a part in April 1977), although much design and test work had been performed by Diggy Mottram's project team at BAe Kingston, by Dowty Boulton Paul (on the crane) and British Robotic Systems (on the capture system), which proved the feasibility of the concept.

In 1985 BAe was privatised and G-VTOL was used for a "photo opportunity" publicity stunt, in which it hovered with the company's share price painted underneath. As hoped for by the management, the photographs were published in all the national daily newspapers, gaining wide publicity for the share issue.

The long and valuable career of G-VTOL was brought to a close on February 19, 1986, after a decade and a half of service which had accumulated some 1,389 flights and 721hr 33min of flying time. Pilots and officials from 19 countries had flown in the faithful G-VTOL, an aircraft that had done much to develop V/STOL operations on land and at sea.

Proposals for further uses of G-VTOL included adaptive camouflage trials, "Harrier 3" large-span wing development flying, Skyhook system development and avionic systems trials as well as continuing chase and pilot training tasks. With this work G-VTOL would still have been flying in the early 1990s. However, the aforementioned projects were not funded by BAe and so this historic aircraft was retired. It now resides at Brooklands Museum near Weybridge in Surrey, where an enthusiastic band of volunteers, including old Hawker hands, keep it in pristine condition with "live" systems.

MIKE STROUD

ABOVE ***Following its retirement in 1986 after a long and productive career, G-VTOL was acquired in 1989 by Brooklands Museum (www.brooklandsmuseum.com), where it is kept in excellent condition and often reunited with old friends, including former test flight observer Mike Craddock, who is a voluntary steward at the museum.***

Extensive use of G-VTOL was made for the testing of BAe's remarkable Skyhook concept, in which a stowable articulated gantry arm, stabilised to neutralise a ship's motion, would be extended over the side to "grab" a Harrier. The pilot would fly under a four-point contact pad and enter the hover. When the pad made contact with the Harrier a jack-rod would be lowered into a socket in the Harrier's fuselage and the arm would bring the aircraft aboard. The idea was successfully tested on numerous occasions, but was not adopted as the Cold War wound down.

VTOL'S INDIAN SUMMER

In the summer of 1972 Hawker Siddeley test pilot **JOHN FARLEY** (seen *above*) was tasked with demonstrating the unique capabilities of the Harrier to the Indian Navy. He recalls two days spent flying G-VTOL on and off Indian Navy carrier *Vikrant* in hot and still conditions that were far from ideal for carrier flying — G-VTOL, however, performed exactly as advertised

The author brings G-VTOL on to the deck of* INS Vikrant *in July 1972. Note the white centreline, marked with measurements from the ship's bow, which ran the axial length of the carrier. This, along with the white broken line to the left marked as a wingtip safety line, was applied specially for G-VTOL's visit. The* Vikrant *was originally built for service with the Royal Navy as* HMS Hercules*, but was launched too late for World War Two and was subsequently mothballed until it was acquired by the Indian Navy in 1957.

PHOTOGRAPHS TAH ARCHIVE UNLESS OTHERWISE STATED

I WAS PARTICULARLY frightened. Robbie Roberts (HSA Sales Executive) knew it too — he was with me at the time. I was trying to get aboard the Indian Navy aircraft carrier *Vikrant*. The weather was not too bad; there was no cloud but at low level the visibility was decidedly murky, only about a mile in a humid subtropical haze over the sea.

In a Harrier of course, you can slow down, and visibility on the approach to land is nothing like the problem that it is to the pilot of a less advanced normal high-performance jet. Alas, at the time, Robbie and I were not in a Harrier but in an Indian taxi, streaking through the narrow crowded streets of Bombay's dockland.

The cause of my fear was that, on several occasions, the young lad driving us used only the horn, when I was absolutely certain that operation of the steering wheel and brakes would be more useful. Fortunately we were not actually involved in an accident, although I fear several people either side of us and behind may not have been so favoured.

WORK BEGINS

Once aboard the ship, we were quickly engrossed in the details of planning the first Harrier operations, which were to take place eight weeks later. A meeting was held with the ship's officers and all the engineering, administrative and flying control aspects were dealt with. All that remained was a period spent on the flight deck, where we were to decide what markings should be painted thereon.

In the end we settled for a centreline 2ft (0·61m) wide down the axial length of the deck, a white line across the bows of the ship for the "nozzles down" indication and a dotted line down the starboard side of the deck, parallel with the centreline, for use as a "wingtip safety line" (behind which all other parked aircraft, men and equipment would be positioned while a short take off — STO — was in progress). More of these lines later, as ideas about them turned out to be a most important new aspect resulting from the subsequent flying.

The Harrier used for this flying was to be two-seat demonstrator G-VTOL. It was fitted with a Rolls-Royce Pegasus 11, the definitive 21,500lb-s.t. engine, specified for incorporation eventually in all RAF and US Marine Corps Harriers. It was to be the first time that the longer and heavier two-seater had been flown from a ship. In our meetings with the Indian Navy, therefore, Robbie and I had been at some pains to point out that we only had estimates of our performance hoped for from *Vikrant*, and that on the day it would require cautious test flying, rather than a simple sales demonstration, allowing us to establish what weights we could

G-VTOL's visit to the* Vikrant *marked the first shipborne activity for a two-seat Harrier, the demonstrator being fitted with "the big motor", the Rolls-Royce Pegasus 11, earlier production two-seaters having been fitted with the lower-thrust Pegasus 6 or 10 engine.

lift from what deck runs, in the hot monsoon conditions expected off the Indian coast in July.

The ferry flight to India had been uneventful, the route being Dunsfold—Naples—Akrotiri—Tehran—Kuwait—Masirah—Bombay. In Bombay the team met up with the monsoons, an intensity of rainfall that someone used to shopping in Woking could not be expected to comprehend. Suffice to say that although the Harrier arrived at Bombay only 20min late on the plans laid two months earlier, we were a day late arriving at Cochin, the Indian Navy base on the south-west tip of India.

FROM SEA HAWK TO HARRIER

This delay meant that the two days allowed for work-up flying from the airfield, before going aboard *Vikrant*, had to be shrunk into a single day. I did not mind this, but it was hard on Captain Tahiliani, Director Air Staff Division, Indian Navy, who was to fly in the rear seat. Since the captain had not previously flown the Harrier, it meant that he had to train very intensively in order to reach the standard necessary for him to control the aircraft himself in the confined environment of the deck. The morning of the first day allocated to the ship dawned hot and humid but fine, and the short flight out to the ship with a vertical landing on the stern was completely straightforward.

Captain Tahiliani remarked as he climbed down to the flight deck that he was the first Indian Navy officer to land a Hawker Sea Hawk on the *Vikrant* (the ship's then-current strike fighter equipment) so he was particularly pleased to take part in the first landing of that aircraft's potential replacement.

Owing to the test-flying aspects of the initial take-offs, it had been agreed that I would fly the aircraft solo the first day and that Capt Tahiliani and two other officers would join in on the second day. Examination of the deck markings showed that they had been painted just where I had asked for them, but unfortunately the 2ft-wide centreline, down which the Harrier would roll, was painted in high gloss paint which was very slippery indeed when it was wet. Since the Harrier is controlled directionally by nosewheel steering it was clear I would have to run slightly to one side of this line.

This caused some concern at first since the obstacle clearance on the left-hand side, with the Harrier on the line, was only 8½ft (2·6m). Running to the right of the line would have taken the wingtip uncomfortably close to the parked aircraft. However, there was an additional line already painted on the deck 7ft (2·1m) to the left of the Harrier line and parallel with it, so it appeared that, provided the Harrier

ABOVE ***Those who experienced one of the author's display routines in G-VTOL will be familiar with the "Farley climb"; the Harrier rises straight into a vertical climb while the undercarriage is swiftly retracted.***

operated between these two lines, all would be well. This was how the matter was left; and after a short period of taxying around the deck, to familiarise the deck handlers with the Harrier, I was all set for the first take-off. This was to be at a light weight down the full length of the 660ft (200m) axial deck.

INTO ACTION

The technique used for the first take-off worked well and was retained throughout the two days of flying. It consisted of free-taxying the Harrier into position at the start of the run, running up to 55 per cent r.p.m. with the brakes on, and the nozzles almost aft at 8° down from the horizontal. On being given clearance to take off, the brakes were released, full throttle applied and the left hand moved from the throttle to the nozzle lever as the run commenced. The aircraft was steered with the nosewheel, controlled by the rudder bar. Finally, when the white line across the end of the deck reached the bottom of the windscreen, the nozzles were lowered to the desired angle marked by a preset stop.

There followed a short period off the end of the deck when I reflected how lucky naval aviators are in not having to climb over anything — from hedges, trees and houses up to hills and mountains — as pilots flying from airfields usually do, and then it was time to jettison fuel and return for a landing on board.

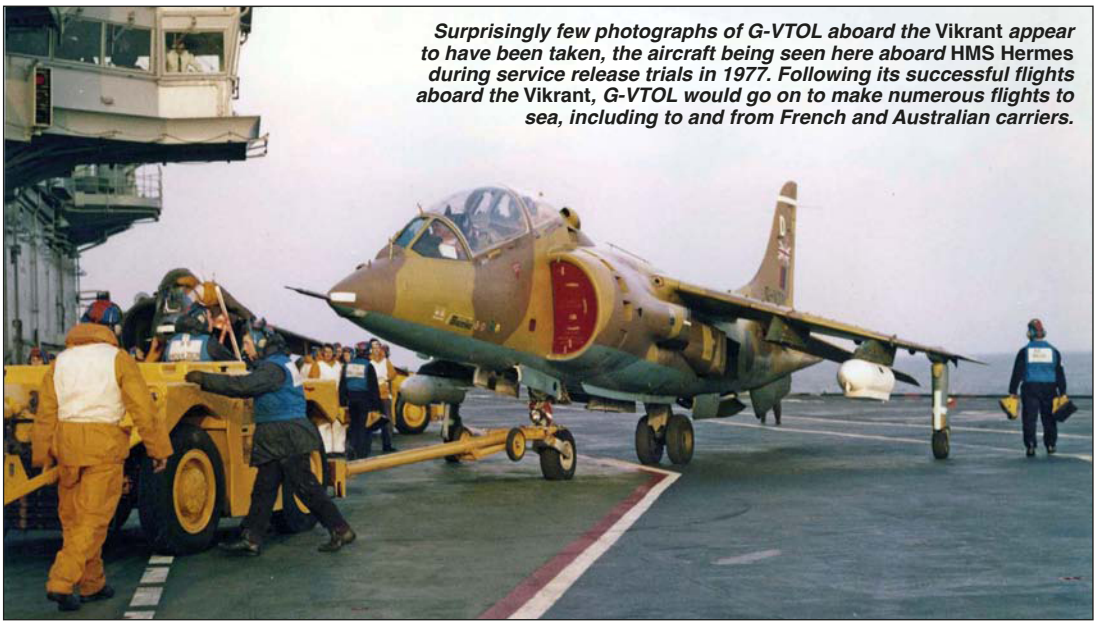
Vertical landings with the Harrier are straightforward because any approach-path errors — slightly high, low, left, right, too slow, too fast etc — can be corrected after the aircraft has come to a hover, whereas in a conventional aircraft pilot carries these errors with him right to touchdown, and so has to fly much more accurately for a long period on the approach, thus working much harder.

In fact the Harrier is so much easier in this regard that one has to remind oneself continually to stay alert and not relax just because it is so straightforward. Overconfidence is not recommended as a state of mind in any vehicle.

After this sortie a second one was performed at the same light weight, to allow me to feel certain I had got used to the technique. Then the groundcrew started increasing the weight by putting more fuel into the aircraft. The third take-off was with full internal fuel, the fourth through to the eighth were all at full internal fuel but the distance of the start point from the end of the deck was reduced down to as little as 370ft (113m). The remaining take-offs on the first day were made with the Harrier as heavy as we could make it using fuel alone, and for these the 100gal combat droptanks were full. The run was eventually reduced at this maximum weight to 585ft (178m).

On the 11th flight the aircraft was landed back at Cochin for the night, with the whole Hawker/Rolls-Royce team, as well as our Indian hosts, well pleased with the day's activities.

The second day's flying saw Capt Tahiliani flying in the rear cockpit for the first six flights. Despite his inexperience in the aeroplane, plus the fact that he was currently employed in a senior staff post and not on full-time flying time duty, Tahiliani had no difficulty in taking control



Surprisingly few photographs of G-VTOL aboard the* Vikrant *appear to have been taken, the aircraft being seen here aboard* HMS Hermes *during service release trials in 1977. Following its successful flights aboard the* Vikrant, *G-VTOL would go on to make numerous flights to sea, including to and from French and Australian carriers.

CHRIS FARARA COLLECTION

Although the Indian Navy was clearly impressed with the G-VTOL demo in 1972, it would be seven years before India would finally commit to the jump-jet in the form of an order for six Sea Harriers in 1979, the first of which was delivered in 1983.

"THIS WAS WHY WE HAD CHOSEN A TWO-SEATER FOR THE DEMO – OUR CLAIM WAS THAT THE HARRIER COULD BE FLOWN BY ANY PILOT TRAINED ON MODERN MILITARY JETS . . ."

of the Harrier outside the hangar at Cochin, and flew entirely unaided into a hover astern of the *Vikrant* 20min later. Of course, this was why HSA had chosen a two-seater for the demonstrator; our claim was that the Harrier could be flown by any pilot trained on modern military jets, but at the time people still tended to doubt it until they had tried it for themselves.

By the end of his six flights on the second day Tahiliani had flown a take-off on the full length of the axial deck and had accompanied me on the first angled-deck take-off using the short 317ft (97m) angled-deck run. I demonstrated a cross-deck landing just aft of the carrier's "island" to show the technique used, when landing a Harrier, if the ship is not steaming into wind. Tahiliani then gave up his seat to Cdr Grewal, Commander Air of the *Vikrant*.

Being a current Sea Hawk and helicopter pilot, Grewal found himself delighted with the Harrier and he performed a decelerating transition to a hover alongside the ship, followed by an accelerating transition back to wingborne flight with no assistance from me other than the odd word of encouragement over the intercom.

"I JUST DON'T BELIEVE IT . . ."

The three remaining flights that day were with Cdr Raju, a Sea Hawk squadron commander, in the second seat. On these flights we covered a vertical take-off from the bow of the ship and a heavy STO from the 310ft (95m) point. The latter allowed those on the bridge the novel experience of looking down into the cockpit of a jet aircraft about to perform a free take-off from a point more than halfway down the deck. It resulted in many "I just don't believe it" comments.

I mentioned earlier about the deck markings and the ideas that resulted from the *Vikrant* operations. The conclusion of the Indians at the end of G-VTOL's demonstration flying was that the Harrier needed a total operating strip no wider that 38½ft (12m). I talked them into this — they had wanted to reduce it by 6ft (1·8m)!

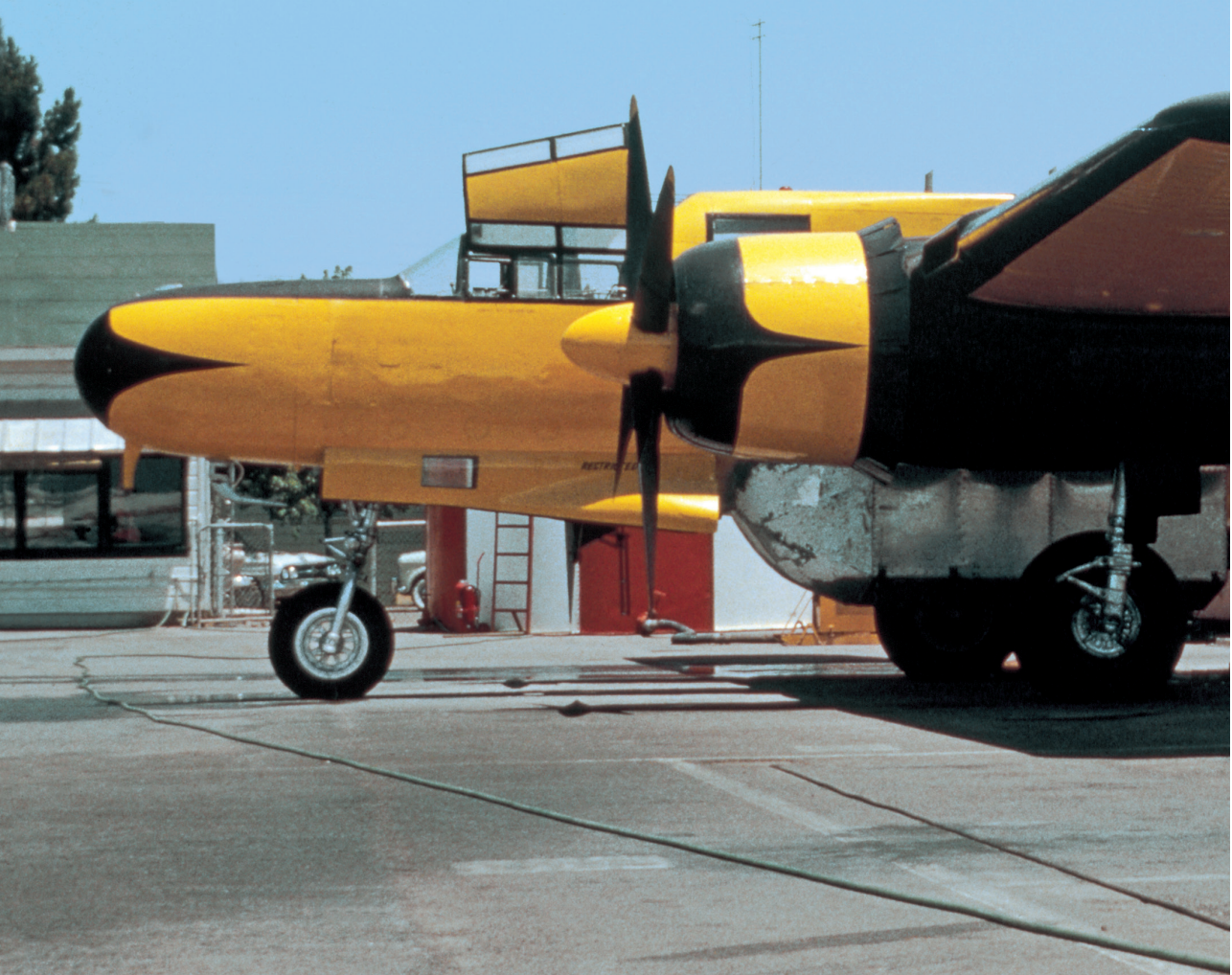
If this strip was positioned down the port side of the ship it left another strip more than 30ft (9·1m) wide down the starboard side for parked and taxying aircraft and equipment. Therefore, because of the Harrier's good control on take-off and the small space needed to perform a simple vertical landing, the concept of an angled deck was no longer important for a Harrier. This had two effects: first, it simplified the design of new ships to straight decks and secondly, it enabled a much wider range of hitherto obsolescent aircraft carriers around the world to become ideal homes for Harriers, offering a wide range of fixed-wing roles at sea with previously unapproachably low levels of capital investment.

The exercise finished, as planned, at the end of the second day. The two days with *Vikrant* had yielded some 21 sorties at an ambient temperature of 30°C and a surface wind that was almost calm (a maximum of 3kt). Despite these ambient penalties the Harrier had once again shown to another potential customer that not only could our brochure performance figures be met, with some in hand, but that the aeroplane could be handled by existing military jet pilots with little special training.

■ *COMING SOON IN* TAH — *John describes flying single-seat Harrier demonstrator G-VSTO on an HSA sales tour to Switzerland in June 1971*

OUT OF THE BLACK

In the first half of a survey of the post-Second World War civil use of Northrop's sleek P-61 Black Widow and its close relative, the F-15 Reporter, ***MICHAEL O'LEARY*** *traces the careers of the few Black Widows that made the transition from uniform to the garish colours of the fire-bomber, were used as testbeds — or simply vanished into the desert*



AFTER ROLLING OUT of the Northrop factory doors at Hawthorne, California, P-61B-1 serial number (s/n) 42-39419 spent most of its career with its parent company on bailment from the USAAF. The aircraft was used for a wide variety of projects and was also employed as a chase aircraft on some of the company's flying-wing projects. Following the end of the Second World War, Northrop Vice-President John Myers (also the company's chief test pilot) negotiated an agreement with the American government that would see this particular P-61 sold outright to Northrop. On January 3, 1946, an application for a civil registration was made, the aircraft becoming NX30020, the first civilian Black Widow. On the same day, an application for airworthiness certification was entered that included plans to convert the nightfighter into an executive transport, and to receive a Limited Type Certificate (LTC) and licence. Northrop also noted that the aircraft would be used for engineering test purposes. A week later a bill of sale for the amount of $6,000 was sent from the USAAF to Northrop.

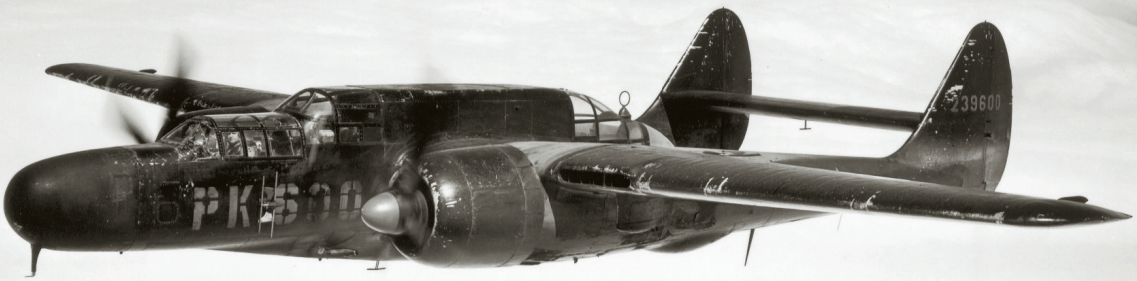
TESTING TIMES

On October 11, 1946, Northrop submitted an application for airworthiness certification to allow the Widow to be used for aerial photography and experimental work in connection with spoiler/aileron research relating to Northrop Project 23 (the Pioneer, which would develop into the unusual YC-125 Raider). At the same time, the registration prefix was changed from NX (Experimental) to NL (Limited) and the Widow was issued with LTC AL-14-1.

Records state that the P-61 was used for numerous experiments including testing the

In its striking yellow and black colour scheme, Northrop P-61B-1 Black Widow N30020 was photographed at Hammer Field, a former World War Two P-61 training base near Fresno, California, on July 4, 1963, while being operated by Idaho-based Ranchers Inc. The aircraft had not yet had its fire-bomber code added; within two months it was destroyed in a fatal crash while fire-bombing.

IMAGES VIA AUTHOR UNLESS OTHERWISE STATED



ABOVE ***Conceived specifically as a nightfighter, and the only American aircraft to be built for that particular role during the Second World War, the P-61 was designed around the advances in Airborne Interception radar. This rather weary P-61B, s/n 42-39600, was photographed while up from Hamilton Field, California, on June 23, 1948.***

original version of the company's SM-62 Snark cruise missile celestial guidance system. The station once occupied by the turret was covered with an optically correct sheet of glass through which the system sighted the stars. Many flights were undertaken before various problems were worked out of the new piece of machinery.

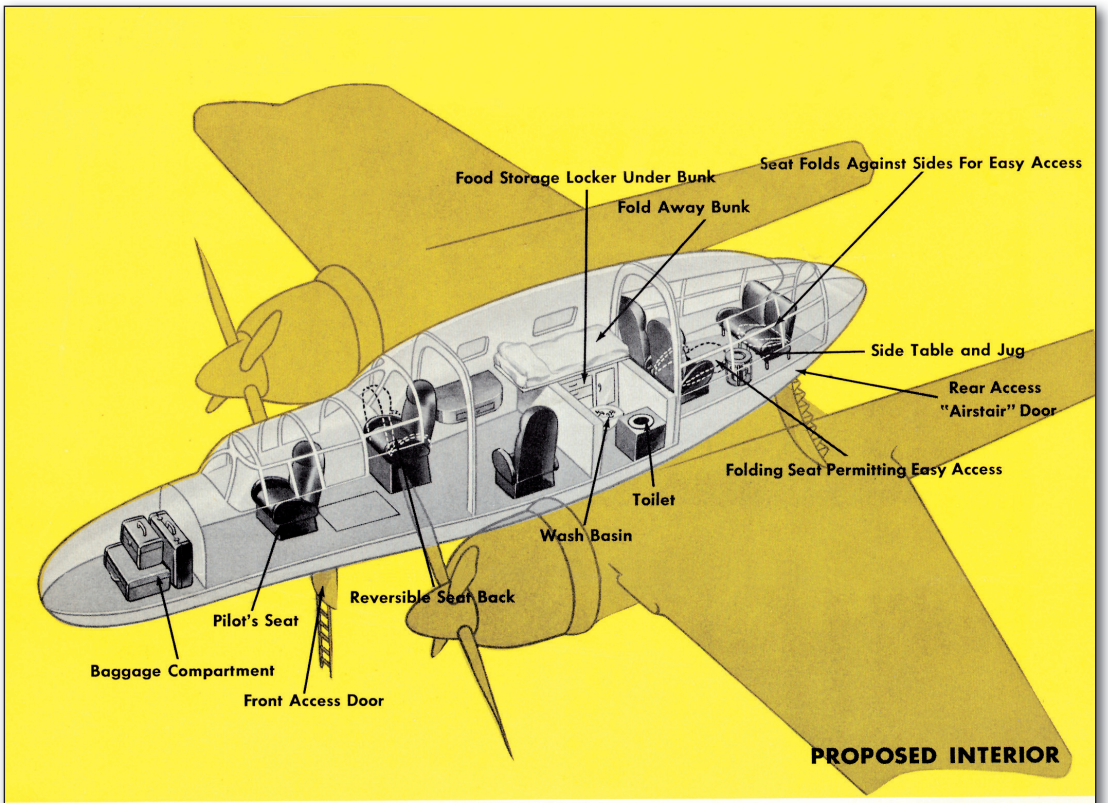
BLACK WIDOW FOR SALE

By the early 1950s Northrop had decided to part with its unique mount and the Widow was put up for sale. A bill of sale was issued on January 5, 1952, from Northrop to Aircraft Sales Ltd of Los Angeles, ownership being transferred for $1 and other considerations — a common method of transacting aircraft sales in order to avoid various taxes. On the same day, ownership was transferred on to Jack Ammann of San Antonio, Texas. The Widow received several modifications to make it suitable for Ammann's aerial photography and mapping business and on February 21, 1953, the aircraft was recorded as having accrued just over 863hr of flight time.

The Widow saw regular use with Ammann, but was also subject to costly repairs, including engine changes, and the company went out of business. As a result, the aircraft was parked at San Antonio airport to await an uncertain future. Aircraft Sales Ltd stepped in to offer the Widow for sale along with a proposed seven-seat executive interior. However, on February 22, 1963, the Widow was sold to the CAL-IDA Aviation Corp of Boise, Idaho, for $10,000.

On April 1 the same year the aircraft was sold on to Ranchers Inc, also of Boise, the new company undertaking major alterations to install a fire retardant tank and turn the Widow into a fire-bomber. A tank of 16,800lb (7,600kg) capacity

ABOVE ***Black Widow N30020 in the elaborate brown, green and orange colour scheme it wore after having been acquired by Jack Ammann Photogrammetric Engineers for aerial survey work. Effective but expensive to run, the Widow spent much of its time on the ramp at San Antonio, Texas, where it was photographed on April 24, 1960.***



NORTHROP P-61B

CAN BE EASILY CONVERTED TO AN EXECUTIVE TRANSPORT

This airplane offers an extremely high payload in its present configuration—8500 lbs. This makes it virtually impossible to overload the airplane through any standard loadings of fixtures, passengers, additional fuel, etc.

An exceptional amount of cubic space is available for an airplane in this performance bracket. A three-place fighter to begin with, much additional space has been afforded by the removal of the turret and other items in the center portion of the fuselage, removal of the four cannon from the belly, and removal of the bulky radar installation in the nose.

An unusual amount of window area and potential window area is incorporated in the construction of the fuselage. Almost the entire after section of the fuselage is window, as is a large section of the upper frontal area. The huge window area in the after section is made possible by the twin boom configuration of the aircraft. In the center of the fuselage, where the turret formerly protruded through the top, a large, round, fully stressed aperture is available for easy installation of a large skylight, or a large observation "bubble" could be installed. Additional windows can be let into the sides of the fuselage.

Passenger seating can be installed for up to ten passengers in addition to the pilot. However, in most cases it would probably be found preferable to seat six passengers in a greater degree of comfort and luxury. An example of such an arrangement would include in the after section a double seat facing aft and a double seat facing forward; the center compartment would include a berth and the lavatory (the berth could be made convertible into additional seating for two); in the next compartment forward would be a seat fixed to one side wall facing a small desk fixed to the opposite wall; between this compartment and the pilot would be an armchair facing forward or aft or installed so as to swivel into either position; additional fuel tanks would be installed in the belly and nose, the nose also providing a large baggage compartment; small items of baggage could be stored under the berth through a door which presently exists; food and drink thermos bottles would be installed at one or more of several possible locations.

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ABOVE ***A page from a rare brochure produced by Los-Angeles-based Aircraft Sales Ltd for potential customers for N30020. The brochure declared that it was "the first time a P-61 has been offered for sale to the public" and encouraged prospective purchasers to consider converting the type into a high-performance executive aircraft.***

was installed within the centre wing-chord area of the fuselage, containing feed tanks of 600 US gal (2,270lit) capacity with a main dropping tank of 1,000 US gal (3,785lit) capacity fixed to main double frames reinforced and attached to the main front and rear steel tubular spars. The control surfaces were re-covered and the armoured-glass windscreen was replaced with 0·5in (12·7mm) Plexiglas.

On April 19, 1963, owner Bob Savaria received a Restricted airworthiness certificate for his new P-61 fire-bomber. During the war Savaria had trained at Hammer Field, Fresno, California, as a P-61 pilot and went on to serve with the 421st Night Fighter Squadron. By August 1963, his logbook had recorded some 19,000hr, more than 1,550 of these on P-61s.

On August 23, 1963, a large fire broke out in the Tule River Indian Reservation south-east of Porterville, California. The State Division of Forestry called in its aerial assets, including Bob Savaria and his Widow, which carried the fire-bomber code E53. At around 1700hr, Savaria was making his fifth drop on the fire when the starboard wing hit the top of a ridge and the aircraft crashed into a canyon and exploded. Thus, the first civilian Black Widow came to a quick and nasty end.

PRATT & WHITNEY'S WIDOW

During and after World War Two, American aero-engine manufacturers Pratt & Whitney (P&W) and Wright built up extensive collections of military aircraft — some on bail from the government, some purchased outright — that were used for testing various powerplants and propellers. During the summer of 1946 representatives from P&W inspected some of the tens of thousands of stored aircraft in yards across the USA, searching for airframes that could be used for company test programmes.

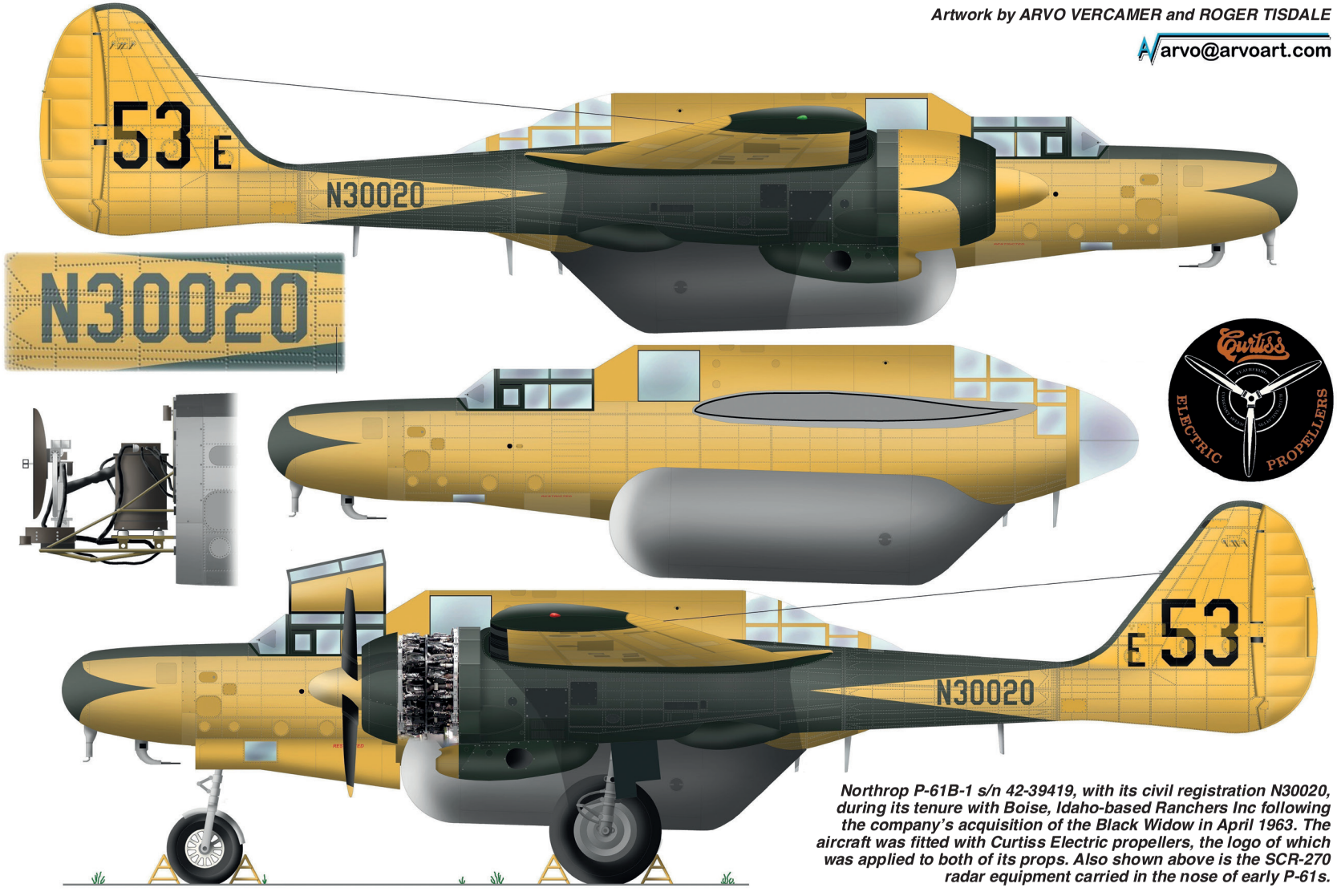
At the large storage yard at Chino, California, P&W representatives found just what they were looking for — YP-61 s/n 41-18888 (the last of 13 Service Test YP-61s), in good condition with low flying hours. Why they picked a YP-61 is something of a mystery as these aircraft often differed from production models in

TOP ***The Black Widow "borate bomber" at Hammer Field, Fresno, in mid-July 1963. The fire-bomber code E53 was allocated to the machine and displayed on its fins.***

LEFT ***The still-smouldering remains of N30020 at the bottom of Gibbon Creek Canyon in the early evening of August 23, 1963. Pilot Bob Savaria was highly experienced, having been in Hawaii on the day of the Japanese attack on Pearl Harbor, the latter prompting him to enlist in the USAAF the same day.***

Artwork by ARVO VERCAMER and ROGER TISDALE

arvo@arvoart.com



Northrop P-61B-1 s/n 42-39419, with its civil registration N30020, during its tenure with Boise, Idaho-based Ranchers Inc following the company's acquisition of the Black Widow in April 1963. The aircraft was fitted with Curtiss Electric propellers, the logo of which was applied to both of its props. Also shown above is the SCR-270 radar equipment carried in the nose of early P-61s.

ABOVE ***The 13th YP-61, s/n 41-18888, parked at the vast surplus aircraft scrapyard at Chino, California. The YP prefix denoted a Service Test aircraft with minor differences from production machines. This P-61 was acquired by Pratt & Whitney and used as an engine and propeller testbed for ten years until it was scrapped after an accident.***

configuration and equipment. On June 6, 1946, P&W purchased the YP-61 from the Reconstruction Finance Corporation (a government entity created to sell war surplus equipment). Put into ferrying condition, the aircraft was flown cross-country to its new home in Connecticut. Given the civil registration N60358, the machine was extensively modified. Both P&W and propeller company Hamilton Standard used N60358 for testing purposes.

The Widow performed its duties efficiently until June 1956, when it was accidently taxied into another aircraft that was having its engine run up. The nose and cockpit of the YP-61 received extensive damage. Pratt & Whitney reasoned that the company had got its money's worth from the aircraft during its decade of operation and that repairs would be prohibitively expensive. By 1956 the type was something of a rarity and it is surprising that some attempt at preservation was not made. It was not to be, and the aircraft was scrapped.

In the mid-1950s, Steward-Davis Inc of Long Beach, California, advertised in aviation journals as having a Black Widow for sale, "converted to your specifications". The aircraft was P-61C s/n 43-8357, which had received civil registration N5094V. Steward-Davis had obtained the aircraft from the National Advisory Committee for Aeronautics (NACA) in 1955, possibly at the same time as it acquired an F-15A Reporter photo-reconnaissance variant of the Black Widow. Photographic evidence of this machine in civil markings remains elusive. Apparently, there were no takers and in 1957 the Black Widow was "converted to parts", i.e. scrapped.

MYSTERY WIDOW

Besides building aircraft Northrop also operated a highly-regarded aviation school for engineers and Airframe & Powerplant Inspectors. Such an endeavour required airframes and the Northrop Aeronautical Institute was no exception. Included in its fleet was P-61C s/n 43-8364.

When the Institute's aircraft became surplus to requirements, they were put up for auction in a sealed-bid sale, the bids being opened at Hawthorne airport on January 15, 1954. The aircraft included North American B-25H s/n 43-5022 (required bid deposit $1,500), Consolidated B-24J s/n 44-51842 ($2,200) and the Widow ($900). A note on the bid form stated that "the P-61 is less engines and certain accessories. These aircraft have had very little flight time and

Only 41 P-61C variants were built, one of which, s/n 43-8330, was used by the National Advisory Committee for Aeronautics for trials before ultimately being acquired by the Smithsonian Institution. It is now on display at the National Air & Space Museum's Steven F. Udvar-Hazy Center in Washington DC.

FROM BOY SCOUTS TO MOONLIGHT SERENADE – MUSEUM WIDOWS

AT THE END of the Second World War, General Henry "Hap" Arnold wanted to preserve one of each type of aircraft operated by the USAAF for a proposed national museum. Accordingly, YP-61 s/n 41-18887 (**RIGHT)** was removed from storage at Chino and flown to Davis-Monthan Field in Arizona, where it joined numerous other aircraft in museum storage. The proposed museum aircraft were parked in a contained area and some form of preservative care was applied to most of the airframes and engines. As time progressed, however, many irreplaceable airframes were removed from the museum storage area and scrapped, including the last surviving Consolidated B-32 Dominator.

In 1950 Air Materiel Command offered the YP-61 to the Smithsonian Institution. However, the latter felt that storing and maintaining the Widow until a new museum could be built was overly expensive. The offer was rejected and, in November of that year, the YP-61 was chopped up and fed into the smelter.

Although the YP-61 had been scrapped the Smithsonian still wanted a Widow to hold in a cost-effective manner for its proposed aviation museum. At Park Ridge, Illinois, the USAF had another storage area for proposed museum aircraft and in this collection was P-61C s/n 43-8330. This Widow had been stored at Andrews Air Force Base in Maryland for several years, during which it was brought back into service and used for NACA testing before going back into storage and later transferred to Park Ridge. In October 1950 the Smithsonian took delivery of the aircraft and transferred it to its Silver Hill storage area in Maryland. After decades of storage, the Widow is now on display at the Steven F. Udvar-Hazy Center at Washington Dulles Airport.

Another of the very few Black Widow survivors owes its existence to the Boy Scouts of America. Stationed at Wright Field for most of its life, P-61C s/n 43-8353 was used extensively for radar test work before being donated to the Boy Scouts of Springfield, Ohio, on May 9, 1949 — probably for use as an educational and instructional airframe. The Widow was moved (perhaps flown) to a small airfield just outside Urbana, Ohio. It was given a coating of flat black paint, and information on how to join the Air Scouts of the BSA was lettered on the starboard side of the fuselage pod (as photographed **ABOVE**). Over the years, the condition of the Widow deteriorated in the harsh Ohio climate and in 1953 the aircraft was sold to Earl Reinert of Wheeling, Illinois.

Reinert was an aircraft and parts dealer and purchased the Widow to acquire the P&W engines (paying $1,500 for the privilege), but he also loved aircraft — indeed, some of today's rarest warbirds survive because of Earl — and he could not face scrapping what he considered a beautiful aircraft. It appears that he never moved the P-61 and on June 20, 1957, the Widow was donated to the USAF Museum at Dayton. Given a new coat of paint and displayed outside for many years, the Widow is now safely inside the National Museum of the United States Air Force and wears the markings of *Moonlight Serenade*, a Widow operated by the 550th NFS, which served with the Thirteenth Air Force in the Pacific during World War Two.

NATIONAL MUSEUM OF THE USAF

RIGHT ***P-61C s/n 43-8353 on display at the National Museum of the United States Air Force in Dayton, Ohio. Used for many years as an instructional airframe by the Springfield Boy Scouts, it is now painted to represent a Pacific War Widow.***

NORTHROP P-61B BLACK WIDOW DATA

THE P-61B VARIANT was the Black Widow produced in greatest numbers, a total of 450 P-61Bs being completed compared to 200 P-61As and only 41 P-61Cs

Powerplant 2 x 2,000 h.p. Pratt & Whitney R-2800-65 two-row 18-cylinder air-cooled radial engines

Dimensions

Span	66ft 0in	(20·11m)
Length	49ft 7in	(15·11m)
Height		
to top of rudder	14ft 8in	(4·47m)
to propeller hub	7ft 0in	(2·13m)
Wing area	662ft²	(61·49m²)
Tailplane span	16ft 8in	(5·08m)
Inner wing flap span	4ft 5in	(1·35m)
Outer wing flap span	16ft 7in	(5·05m)
Aileron span	4ft 9in	(1·45m)
Crew nacelle		
length	33ft 10in	(10·31m)
width	49in	(1·25m)
Dihedral		
inner wing	4°	
outer wing	2°	
Propeller diameter	12ft 2in	(3·70m)
Prop clearance (tips)	11in	(27·94cm)
Undercarriage track	17ft 7in	(5·36m)
Root chord	144in	(3·66m)
Mean aerodynamic chord	126·3in	(3·21m)

Weights

Empty	22,000lb	(9,979kg)
Loaded	29,700lb	(13,472kg)
Maximum take-off	38,000lb	(17,237kg)

Performance

Maximum speed	366 m.p.h at 20,000ft	(589km/h at 6,100m)
Cruise speed	200 m.p.h.	(322km/h)
Landing speed	93 m.p.h.	(150km/h)
Climb	12min to 20,000ft	(6,100m)
Service ceiling	33,100ft	(10,100m)
Range	1,010 miles	(1,625km)

Armament 4 x 20mm cannon; 4 x 0·50in machine-guns; 6,400lb (2,900kg) of bombs

were originally purchased for school training".

The winning bidder was Robert F. Bean, confirmed in a letter dated February 23, 1954, from the General Services Administration to the CAA. The B-25 became N4903V, the B-24J N4904V and the P-61C N4905V.

It is unclear what Bean intended to do with the aircraft, but he was a well-known supplier of parts and aircraft to Latin American air forces. On February 28, 1958, he wrote to the CAA to continue registration of the three machines. His rather confusing letter stated, "We also enclose Form ACA-1911-1 requesting cancellation of Registration Numbers covering these same three aircraft. For the past year, we have been in the process of dismantling and cannibalising these 'planes, with the intent of using them for parts. However, in the future we may be desirous of reassembling and licensing one of them — so, for this reason, we would like to have ownership registered in the name of 'Robert F. Bean' so that clear title to the 'planes will be no problem at that time".

"IT'S OUT THERE . . ."

This has led to an interesting mystery regarding this P-61. In the late 1960s Bean was operating out of Blythe Airport, a remote desert field in California housing some of Bean's Vought Corsairs and Lockheed Lightnings. Bean had become something of a religious zealot and would hand out religious tracts to anyone that wanted to see the aircraft. Talking about an upcoming Armageddon, Bean even mentioned a

Owing to the inscription* "Hap" Arnold Air Scouts *on the nose of this Widow, it was assumed that it was P-61C s/n 43-8353, but its "buzz number" (PK-300 on the port boom) and the fact that it is a P-61B indicate that it is another machine entirely, about which nothing appears to be known.

MID-ATLANTIC AIR MUSEUM

P-61B s/n 42-39445 is currently under restoration to airworthy status by the Mid-Atlantic Air Museum at Reading, Pennsylvania, and is seen here in an advanced stage of completion at a museum event in June 2010.

modern ark constructed from aircraft aluminium. When questioned about the Black Widow, Bean would gesture with a sweep of his hand, point to the desert and say "it's out there".

Carl Scholl of restoration specialists Aero Trader remembers Bean well. "In 1980, Tony Ritzman and myself were assigned the task of clearing out a large wooden building at Blythe Airport that had been used by Bean for storage. It was more than 200ft long and packed with parts. We were surprised to find two P-61 engine mounts in the weeds. Inside there was a P-61 nose undercarriage unit on a pallet — the P-61's main undercarriage was identical to that of the B-25 and those components may have gone into our pile of B-25 parts. Also, we found a top turret for a Widow as well as a set of the unique airbrakes. The nose undercarriage and engine mounts eventually went to the Mid-Atlantic Air Museum for its project [see panel at right] while Yanks Air Museum has the top turret and airbrakes. There were thousands of pounds of other smaller items and junk that were eventually trucked to the Blythe dump where they were buried. We never saw any evidence of large components from a Black Widow".

Were these the final mortal remains of Bean's Widow or just spare parts — and is the airframe still stored in a remote desert building, awaiting discovery? Time will tell!

■ *NEXT TIME — the Widow's reconnaissance variant, the F-15 Reporter, in post-war civil service*

A WIDOW TO FLY AGAIN

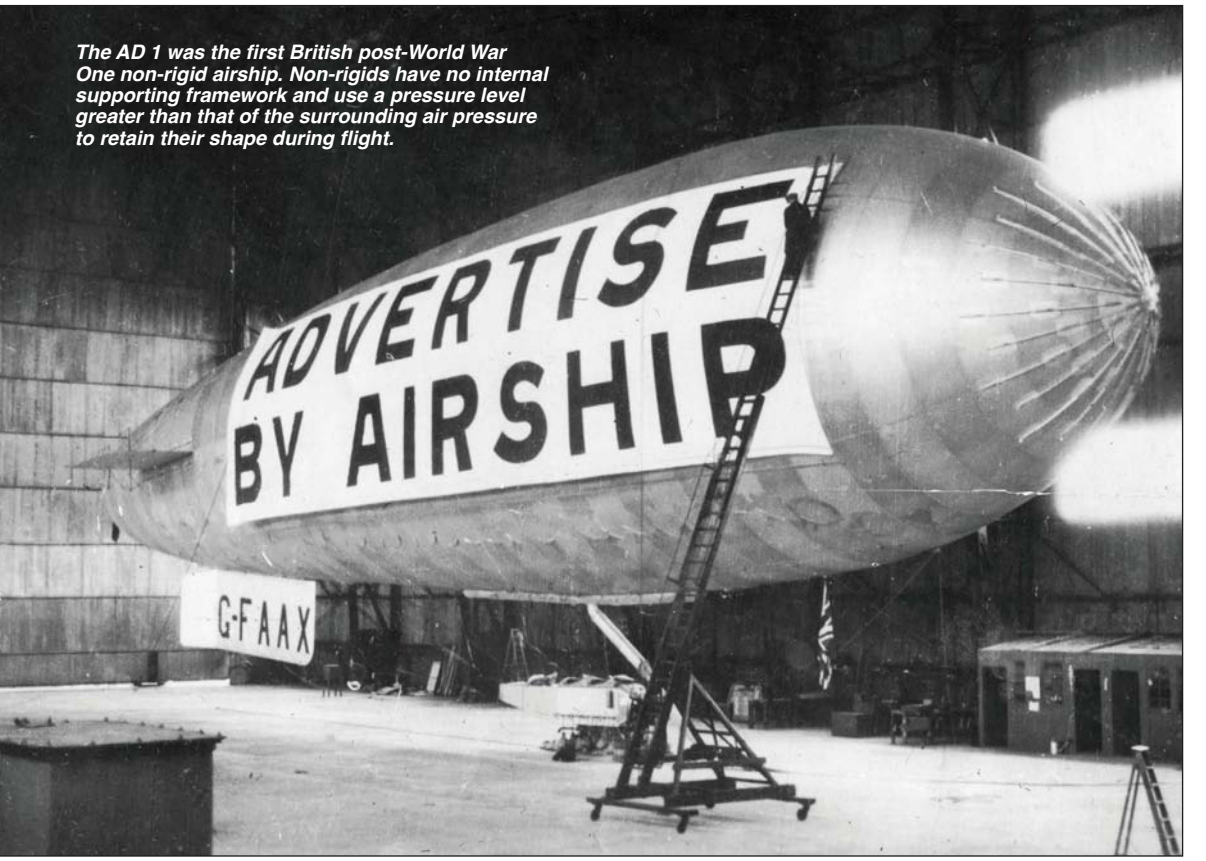
OVER THE YEARS aviation enthusiasts have kept an eye on work being undertaken on P-61B s/n 42-39445 by the Mid-Atlantic Air Museum (MAAM) at Reading, Pennsylvania. In January 1945 a pilot from the 550th Night Fighter Squadron (NFS) crashed the aircraft while trying to outclimb Mount Cyclops near Hollandia in Dutch New Guinea (now part of Indonesia). The Widow was damaged, but the crew was largely unhurt and, after they had made their way back to civilisation, the airframe was simply abandoned since recovery would have been extremely difficult, if not impossible.

Some 40 years later, the news that the aircraft was still where it crashed was received by MAAM co-founder Eugene "Pappy" Strine. Realising the rarity of the relic, Strine visited the crash site and began raising money to recover the Widow.

Numerous trips saw the Widow dismantled piece by piece. In 1991 a large clearing was cut around the wreck and an Aérospatiale Super Puma helicopter began lifting the components from the site to be transported to an area where they could be crated for onward shipment back to the USA.

Some 15 crates, weighing a total of 26,000lb (11,800kg), were shipped to Pennsylvania where the daunting task of returning the Widow (assigned civil registration N550NF) to flying condition began. Progress has been slow, but it also has been steady and the efforts of the MAAM will eventually result in the world's only flying Black Widow.

For more information on the MAAM and its Black Widow project, visit the website at www.maam.org/p61/p61_rest.htm.



The AD 1 was the first British post-World War One non-rigid airship. Non-rigids have no internal supporting framework and use a pressure level greater than that of the surrounding air pressure to retain their shape during flight.

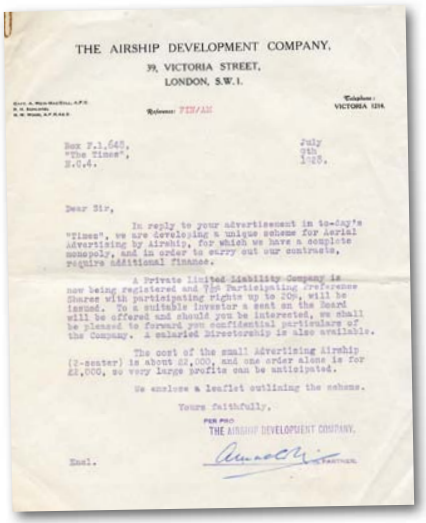
AUTHOR'S COLLECTION

AN AIRSHIP INTERLUDE

The ambitious rise and ignominious fall of the Airship Development Company's AD 1, Britain's first post-First World War non-rigid airship

by BRIAN J. TURPIN

IN THE SUMMER of 1929 the airship world was eagerly awaiting the maiden flights of the two new giant British passenger airships, R100 and R101, designed to be operated on the Empire routes of the Imperial Airship Service. As the lights burnt long into the night at Howden, where R100 was taking shape under the watchful eye of Barnes Wallis, and the



THE AIRSHIP DEVELOPMENT COMPANY,
39, VICTORIA STREET,
LONDON, S.W.1.

Telephone:
VICTORIA 1214

Reference: TTH/AM

Box F.1,649,
"The Times",
E.C.4.

July
9th
1928.

Dear Sir,

In reply to your advertisement in to-day's "Times", we are developing a unique scheme for Aerial Advertising by Airship, for which we have a complete monopoly, and in order to carry out our contracts, require additional finance.

A Private Limited Liability Company is now being registered and 7% Participating Preference Shares with participating rights up to 20%, will be issued. To a suitable investor a seat on the Board will be offered and should you be interested, we shall be pleased to forward you confidential particulars of the Company. A salaried Directorship is also available.

The cost of the small Advertising Airship (2-seater) is about £2,000, and one order alone is for £2,000, so very large profits can be anticipated.

We enclose a leaflet outlining the scheme.

Yours faithfully,

PER PRO
THE AIRSHIP DEVELOPMENT COMPANY.

Encl.

ABOVE ***A confident letter, dated July 9, 1928, from the Airship Development Company's head office in London to a prospective investor, extolling the virtues of aerial advertising by airship, "for which we have a complete monopoly".***

RIGHT ***The company's chief engineer, Reginald Herbert Schlotel, beside the AD 1 in 1929. Schlotel went on to become the Director of Research & Development at Power Jets, before moving on to the Ministry of Supply, where he served as Director of Engineering, and for which he was awarded a CBE in 1959.***

LETTER: PHILIP JARRETT COLLECTION

AUTHOR'S COLLECTION

Royal Airship Works at Cardington, where R101 was nearing completion, a rather less ambitious project was slowly taking shape in a small airship shed in Northumberland. The airship in question was the AD 1, G-FAAX, the first product of the Airship Development Company, and the first British post-war non-rigid airship to fly.

This rare private venture into the art of airship design was the brainchild of millionaire businessman T.N. Pickett, the company's managing director and founder, who believed that there was a market for small non-rigid airships for use by private owners and for private hire, aerial survey and photography, police patrols and aerial advertising. It was the last-named role which eventually enabled the airship to be completed and flown. The company also offered its services to take on contract work, and in a contemporary advertisement indicated that it was in a position to design and manufacture airships and kite balloons to customers' specifications, and to undertake airship fabric work of all descriptions.

The AD 1

The new company's head office was at 39 Victoria Street, London, but the ship was constructed in an airship shed at Cramlington, a few miles to the north of Newcastle, the site of one of the last Royal Naval Air Service (RNAS) airship stations to be opened in the last months of World War One.

The company's first product, the AD 1, was designed by J.R. Pike. The chief engineer was R.H. Schlotel and the company's first chief pilot was ex-RNAS airship pilot Capt A. Weir-MacColl AFC, who also helped with the design. The company chairman was Mr L. Aldridge. Both Schlotel and Weir-MacColl had been employed previously by British Airship Ltd, which had tried to launch a more ambitious airship project in 1927.

The AD 1 was fully described in the November 8, 1929, issue of *Flight*, the magazine appearing quite enthusiastic about the whole concept and purpose of the craft:

"The uses to which such a ship can be put are, of course, very many and such work as forestry inspection, fishery control, police patrols, aerial photography, aerial survey, training of airship pilots and crews, aerial advertising and joy-riding are all within its scope and in some respects it is definitely more suited to the work than a heavier-than-air craft. It can fly safely at low altitudes and can cruise at a very low speed, in fact, if necessary it can almost hover, which, for survey work where the flora or geological strata have to be examined closely, is obviously a great advantage as compared with an aeroplane."

On the subject of aerial advertising the magazine noted: "Aeroplanes have been used for advertising purposes but their high speed and the danger which attends their flight over populous areas inhibits their use to any great extent . . ."

Design and construction

Based on the wartime Submarine Scout airships, which had been operated very successfully in large numbers by the RNAS between 1915 and 1918, the AD 1 had a cubic capacity of 60,000ft³ (1,700m³) of hydrogen, giving a gross lift of some 4,250lb (1,928kg) and a disposable lift of 1,500lb (680kg). It was designed to be flown by a crew of two at a cruising speed of 35 m.p.h. (56km/h) with a respectable top speed of 50 m.p.h. (80km/h).

The envelope, made by the RFD Company of Guildford, Surrey, was built up from panels of two-ply rubberised aluminium-doped fabric, all seams being double-stitched, lapped, cemented and taped to ensure good gas-tight joints. The rubber proofing between the plies minimised gas diffusion, and the aluminium dope on the outside protecting the fabric from the effects of sunlight. The shape of the envelope was maintained by the internal gas pressure, which in this airship was equal to a 25mm head of water. To prevent the nose of the envelope from being blown in when the airship was flying, shaped wooden members, wrapped with glued tape, were laced to the envelope. These ribs were carried back beyond the point where the dynamic pressure on the nose became zero. The very tip of the nose was covered with a metal cap.

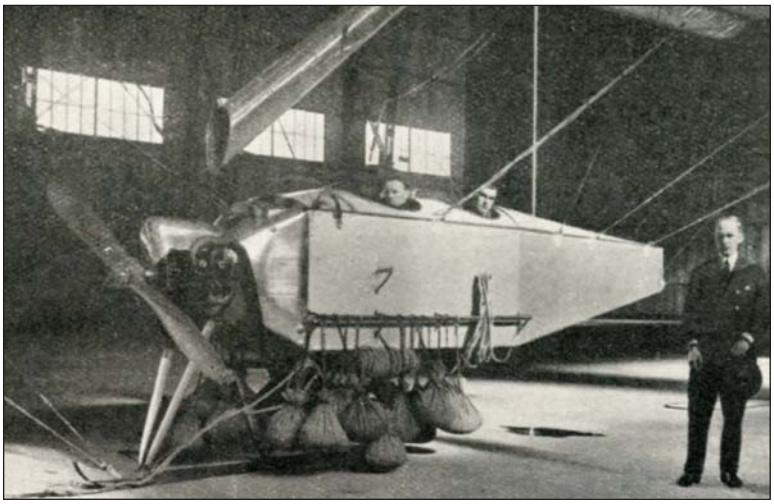
To compensate for changes in the pressure in the "hull", and to trim the ship fore and aft, two air bags (ballonets) were placed inside at the bottom of the envelope. These were provided with air from a metal airscoop mounted in the slipstream behind the airship's propeller. This air was directed along fabric ducts, via control valves, to the ballonets. When the main engine was not in use an auxiliary blower of 1 h.p. was provided in the forward cockpit. This could be used when the airship was moored out so that envelope pressure, and therefore the envelope shape, could be maintained.

Two gas-valves were fitted, one on top of the envelope being operated by the pilot by means of a valve cord, the other at the bottom just aft of the rudder opening automatically if the internal pressure of the envelope reached 40mm head of water.

ADC AD 1 AIRSHIP DATA

Powerplant 1 x 75–82 h.p. ABC Hornet horizontally-opposed four-cylinder air-cooled piston engine driving a two-bladed wooden propeller

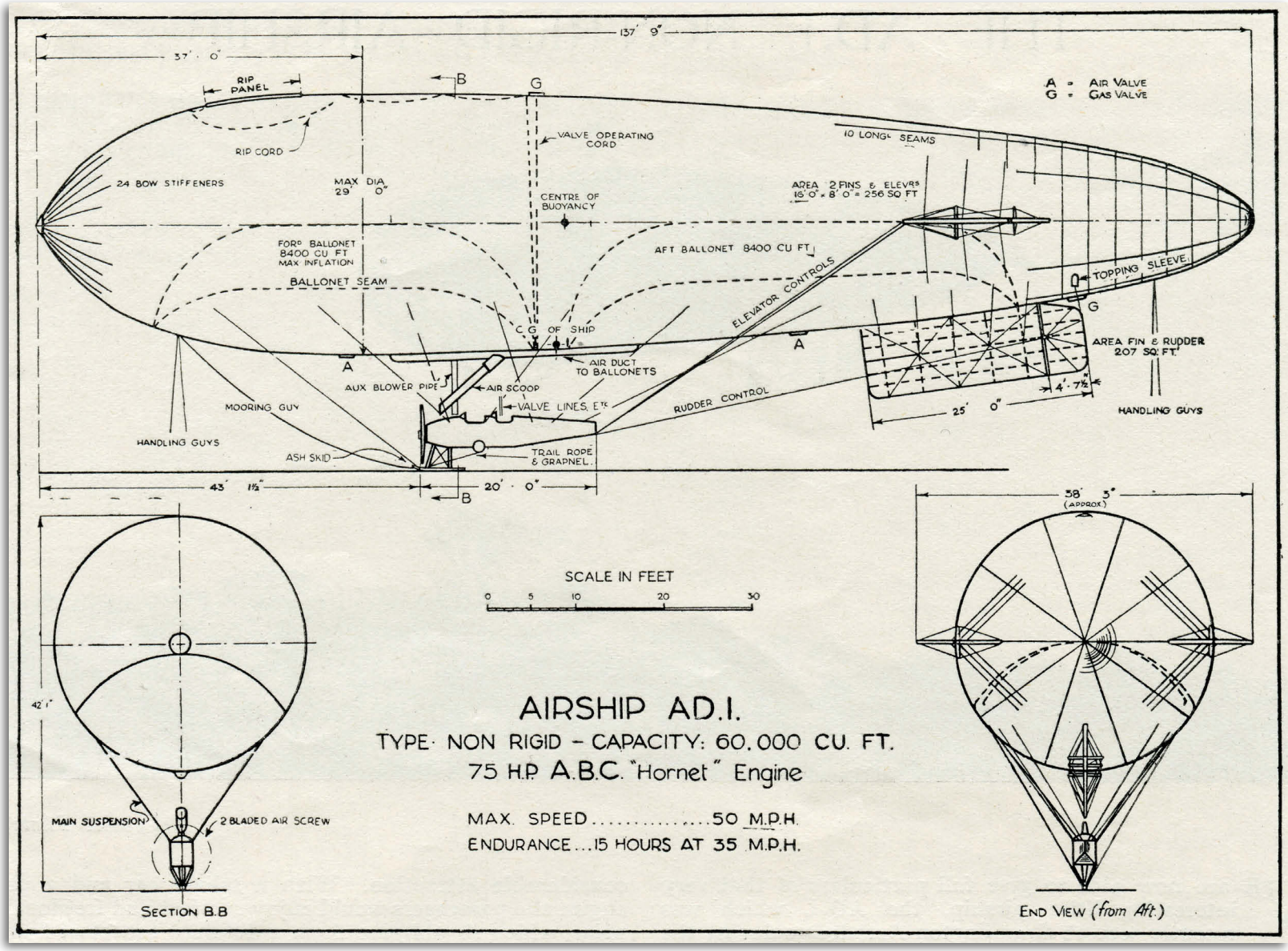
Dimensions		
Overall length	137ft 9in	(42m)
Maximum diameter	29ft 0in	(8·85m)
Envelope capacity	60,000ft³	(1,700m³)
Ballonet capacity	16,800ft³	(475m³)
Weights		
Dead weight	2,750lb	(1,250kg)
Disposable load	1,500lb	(680kg)
Payload with range of 500 miles (800km) at 1,000ft (300m)	550lb	(250kg)
Performance		
Maximum speed	50 m.p.h.	(80km/h)
Cruise speed	35 m.p.h.	(56km/h)
Endurance with normal tankage	15hr at cruise speed	
Ceiling with crew of two and fuel for 500 miles (800km)	5,000ft	(1,500m)
Maximum range with extra fuel	1,000 miles	(1,600km)



AUTHOR'S COLLECTION x 2

LEFT ***The control car of the AD 1, with the airship's designer, J.R. Pike, standing to the right, with Capt Beckford-Ball in the pilot's cockpit and Flt Sgt Long in the coxswain's cockpit behind him. Descending from the envelope is the airscoop, which fed forward and aft ballonets of 8,400ft³ (238m³) capacity each.***

OPPOSITE PAGE ***In its November 8, 1929, issue,*** **Flight** ***provided a full technical report on "that very interesting little airship, the AD 1, which was recently seen at Cramlington during the Newcastle Air Pageant". Included in the article was a diagram showing the salient points of the airship.***



AIRSHIP AD.I.

TYPE· NON RIGID – CAPACITY: 60.000 CU. FT.

75 H.P A.B.C. "Hornet" Engine

MAX. SPEED.....50 M.P.H.

ENDURANCE...15 HOURS AT 35 M.P.H.

There were also two air-valves, one under each ballonet, which would open at 30mm pressure and could also be opened by the pilot.

The flight control system consisted of a single ventral fin, carrying a rudder, and two horizontal tailplanes, each carrying an elevator. These were made up of wooden spars and ribs, internally wire-braced and covered with doped-linen fabric. They were braced externally with kingposts and wires, and secured to the envelope by eyebolts fixed to spruce skid cross-members which were laced to patches on the envelope.

The control car and powerplant

The control car resembled the fuselage of a light aircraft and was made in the same way with spruce longerons and frames, covered with plywood which was itself covered with fabric and painted with aluminium dope. The car was suspended from the envelope via "Eta" patches and a complex rigging system of flexible steel cables and pulleys. This system was designed to spread the weight of the car over a large area of the envelope in order to avoid undue strain on any one part of the envelope fabric. At the forward end of the car was a large metal-shod skid made of ash, which was designed to protect the propeller and absorb landing shocks. It could also be used in flight to make adjustments to the engine. Handrails were fitted along the bottom of the car for manhandling the ship on the ground. They were also used to carry sand ballast bags, a grapnel and ropes.

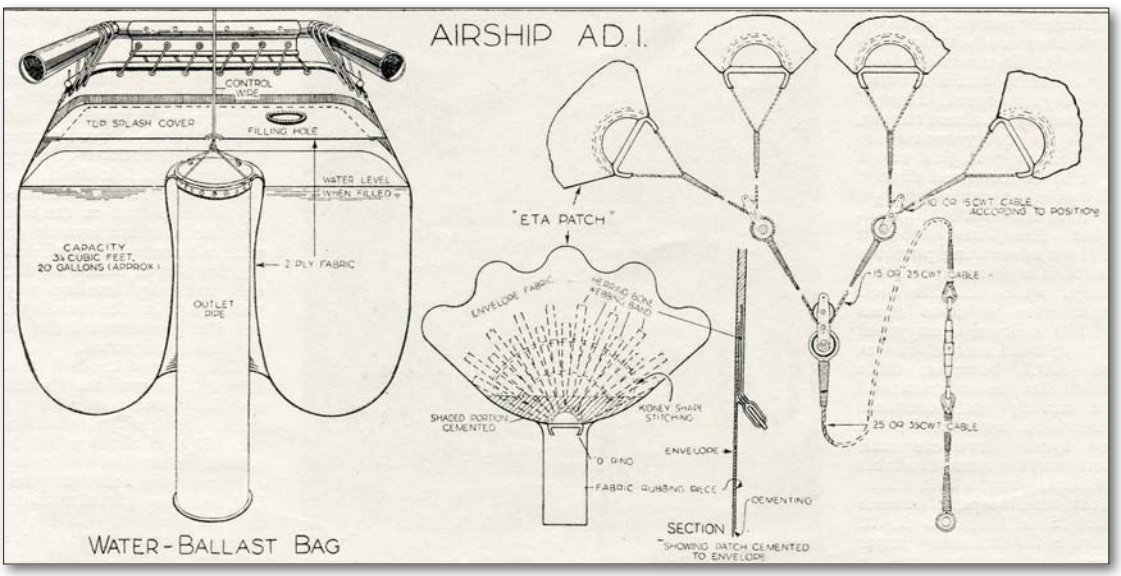
An air-cooled ABC Hornet engine of 75–82 h.p. was mounted on a rigid steel frame and attached to the forward fireproof bulkhead of the car. It was cowled with shaped aluminium panels. The engine drove a wooden two-bladed propeller.

Behind the engine were the coxswain's and pilot's cockpits, arranged in tandem. Control duties were shared between the two, the coxswain operating the rudder and elevator handwheels, and the pilot an elevator wheel, the throttles and the gas and air valve controls. Both cockpits had all the essential flying instruments.

Abaft the pilot's cockpit was space for the essential water ballast bag which could hold 20gal (91lit). Between the cockpit and the ballast bag was the main fuel tank with a capacity of 35gal (159lit). At the front of the car there was a service tank holding 3gal (14lit). This was sufficient fuel for a 1hr flight at cruising speed, the tank being fed from the main tank by means of a handpump worked by the coxswain. There was also a 4gal (18lit) oil tank behind the engine, the oil being cooled by a "Vickers oil cooler". *Flight* commented:

"The ship, of course, has been designed to Air Ministry requirements in order that she may have a full C of A, and the conditions of design and factors laid down in [the Aeronautical Research Committee's] *Reports & Memoranda No 1170* have been followed throughout. The reserve lift has been found to exceed that expected and a seat for an additional passenger is therefore being arranged behind the pilot in the AD 1, and in the AD 2, which is now nearing completion, proper additional passenger or freight space is being allowed for."

Inflation of the envelope began on September 2,



AUTHOR'S COLLECTION

ABOVE ***Another of the diagrams published in the* Flight *article on the AD 1, this one showing the water-ballast arrangement and main suspension attachment to the envelope using "Eta" fan-shaped patches. These were named after the Army's last experimental airship,* Eta*, of 1913, which incorporated this innovative new suspension system.***

The AD 1, with its gigantic hoarding fitted and wearing its registration, G-FAAX, at Cramlington in 1930. The airship station had opened in 1918 at Nelson Village, but was close enough to the Royal Flying Corps airfield at Cramlington to be given the same name. The airfield makes an appearance in Capt W.E. Johns's 1935 "Biggles" adventure, **The Black Peril.** PHILIP JARRETT COLLECTION

1929, and rigging was completed on the 10th when the ship emerged from its shed for the first time but was not flown. On the evening of September 13 (a Friday), the AD 1 was brought out again and at 1810hr took off for a successful first flight of 20min. In command was Capt Weir-MacColl, ably assisted by J.W. Long as coxswain. It was Weir-MacColl's first flight for ten years.

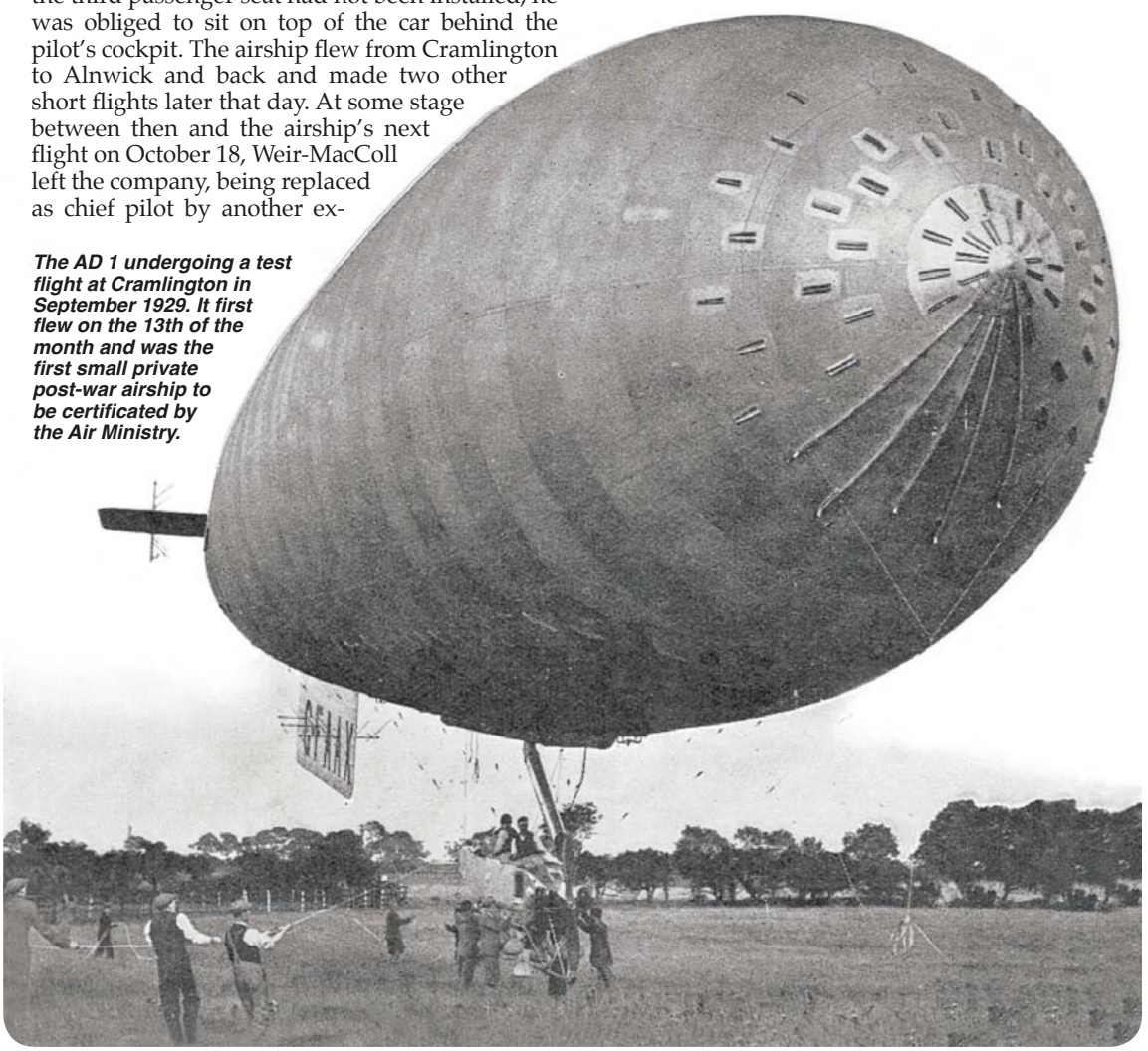
Among those present that evening were Mr F. McWade from the Royal Airship Works at Cardington, who was acting as the official Air Ministry inspector of the ship, Mr Pike the ship's designer and Mr A.F. Elliot from the ABC Motor Works. Also present was that indefatigable advocate of the airship, the Hon Arthur Eveleigh-de-Moleyns, later Baron Ventry, who became the official airship correspondent of *The Aeroplane*.

The second flight was made at 1200hr on September 18, again with Weir-MacColl and Long in control and with Colonel Outram of the Aeronautical Inspection Department as passenger. As the third passenger seat had not been installed, he was obliged to sit on top of the car behind the pilot's cockpit. The airship flew from Cramlington to Alnwick and back and made two other short flights later that day. At some stage between then and the airship's next flight on October 18, Weir-MacColl left the company, being replaced as chief pilot by another ex-RNAS airship pilot, Capt J.A. Beckford-Ball, who had joined the company the previous July.

The next flight took place on November 6, when Capt G.F. Meager flew the ship with Beckford-Ball to perform a Certificate of Airworthiness test flight. Having passed this hurdle successfully, the AD 1 made one more flight, on November 29, and was then deflated so that various modifications could be made. These included the fitting of hand starting and dual ignition for the engine, foot steering in place of the handwheels, and the third cockpit for passengers.

Meanwhile, on October 12, R101 was brought out of its shed at Cardington for the first time, making its initial trial flight on October 14, under the command of Flt Lt Carmichael "Bird" Irwin. On December 16, R100 made its maiden flight from Howden to Cardington, commanded by Sqn Ldr Ralph Booth.

The AD 1 was laid up for the rest of the winter and it was not until May 26, 1930, that the airship



The AD 1 undergoing a test flight at Cramlington in September 1929. It first flew on the 13th of the month and was the first small private post-war airship to be certificated by the Air Ministry.

VIA GILES CAMPLIN / AIRSHIP HERITAGE TRUST

For its flight over London on July 25, 1930, the airship carried its normal crew of two plus engineer Sgt Sansom, who had to perch on the fuselage behind the coxswain's cockpit. The craft had banners proclaiming "This Space To Let" on the port side and "Advertise By Airship" on the starboard side.

PHILIP JARRETT COLLECTION

flew again, making five short test flights that day. Jack Beckford-Ball was again in command, as he was to be for all subsequent flights. For the new flying season it was now imperative that the company acquire some form of advertising revenue if operations were to continue. Up to this point, the airship had been flying with large banners, 75ft (23m) long by 20ft (6m) deep, laced to the sides of the envelope and bearing the message "This Space to Let".

A new flying season

Fortunately, a sponsor was found in the form of Walter Wilson Ltd, which operated a chain of food shops in the north of England. When the AD 1 next flew, on May 31, the banner read "Walter Wilson On Top". This flight from Cramlington lasted more than 5hr, most of it spent cruising over Newcastle and the local area. The captain was later prosecuted for low flying near Ebchester when the sight of the airship caused a horse to bolt. He was fined £2 2s with £4 18s costs.

Two further flights were made for the same company. The first, on June 3, started at 1520hr and took the ship north to Morpeth, Ashington, Newbiggin and Blyth, to land at Holywell at 1650hr where the AD 1 remained overnight. The following day, at 1150hr, the AD 1 flew to Whitley Bay, Tynemouth and Gateshead, and then south to Chester-le-Street, Durham, Bishop Auckland and Darlington. The return trip to base was via West Hartlepool and Sunderland, to a landing at Cramlington at 1600hr.

Then on Saturday, June 21, AD 1 left its base and headed south. The plan was to fly as far as Grantham, stop there and refuel overnight, and then continue on to Folkestone the next day. It was to be supported by a groundcrew consisting of an engineer and two riggers. The flight crew was Jack Beckford-Ball and J.W. Long. Having left Cramlington in perfect weather conditions, the airship encountered strong headwinds on the way south to Lincoln, the winds rising steadily to about 40 m.p.h. (64km/h) as Grantham was approached. As *Flight* reported on August 1:

"The ship was pitched about somewhat but behaved splendidly and it speaks well of her crew, who were naturally out of practice, that she reached base and landed in safety. She remained moored out in natural shelter, weathering some very high winds with complete success . . ."

The landing ground was at Little Ponton, about two miles south of Grantham, near to the Great North Road. The AD 1 remained there, riding out the winds, until 0600hr on June 26, when the weather finally improved and it was able to proceed south. Shortly after take-off, engine trouble forced a return to its temporary moorings and it was not until 0800hr that it finally left. Its destination was to be the site of the old airship station at Capel-le-Ferne, on the cliffs near Folkestone, the airship's route taking it over Peterborough, Cambridge, Southend, across the Thames to Kingsnorth and then to Canterbury.

The AD 1 landed at Capel-le-Ferne at 1315hr, with the assistance on the ground of another ex-RNAS airship officer, Capt D. Knowles DSC. The landing ground was about 400yd (1,200ft — 365m) from the widened Folkestone—Dover road, behind the sheds used by South Coast Motor Services as repair shops. The AD 1 was itself in need of some repair, as during the trip south the top gas valve had given problems, the exhaust pipe had blown out and the propeller began to work loose.

PHILIP JARRETT COLLECTION

ABOVE ***The AD 1 at its landing ground near the former RNAS airship station at Capel-le-Ferne during June–July 1930. This natural cavity with a belt of trees around it at West Hougham was a "secret hiding place" during the war for the nearby station's airships, which would be removed from their sheds and hidden there during air raids.***

The airship was not ready for service again until July 13, when it was flown from Capel-le-Ferne to East Horsley, near Leatherhead in Surrey. It was moored out in the lee of high trees in the grounds of Horsley Towers School. From here it was intended that the AD 1 should make its first flight over London.

Trouble over the capital

On the night of July 14 strong winds and torrential rain threatened to damage the airship and it was necessary to move it to a more sheltered position with the aid of the ship's crew and a hastily-assembled volunteer handling party. Once secured in its new position, the airship rode out the gale, but it was not until July 25 that the weather cleared sufficiently for the flight to be made over London. On this 3hr trip the AD 1 flew round Big Ben and St Paul's in grand style and cruised about over the city for some time.

Thereafter, things started to go wrong. The cable for the Aldis lamp became snagged with the rudder cable, causing problems with the steering. The engineer on board decided to cut the lamp cable, which promptly blew the electrical fuses, resulting in the loss of two engine cylinders. Having sorted out the steering, and with a very rough engine threatening to stop at any moment, the airship was steered back along the river towards East Horsley, where eventually a safe landing was made.

After the London flight it was decided to replace the AD 1's engine with a Rolls-Royce Hawk of 75 h.p., the type of engine which had been used successfully on many of the RNAS anti-submarine airships, such as the *SS Zero*. The engine change was completed by early August and the airship set off on a test flight which was to include a one-mile (1·6km) speed run between East Horsley and Effingham. As the airship slowly accelerated, a handling guy swung up into the propeller, which broke and threw a blade into the envelope. The envelope began to lose gas and the badly vibrating engine fractured the fuel pipe. With lift rapidly reducing and fuel pouring from the broken pipe, the AD 1 was steered towards an open field for an emergency landing. As the airship neared the ground, the engineer jumped out too early and knocked himself out. The craft continued to descend and almost landed on top of him. With gas escaping from the torn envelope, there was nothing else to do but deflate the airship where it stood.

This was a serious setback, as the airship was scheduled to leave England for Belgium on August 22, 1930, for an extensive advertising campaign for the British-American Tobacco Company (Belgium) Ltd. Flights were planned from Ostend on August 23, and the following day the airship was supposed to fly over an exhibition at Antwerp before landing near Brussels that evening.

The AD 1 was taken by road to Capel-le-Ferne

where repairs were made to the envelope and engine. This proved to be a lengthy process and it was not until the evening of September 16 that the AD 1 was flown again. It now carried a large banner reading "Gold Dollar Blended".

From bad to worse

After a brief test flight in the local area the airship set course across the Channel for Ostend with the intention of landing at the racecourse to the south of the town. Hundreds of people gathered to see the airship arrive, but by the time it got there it was too dark to land safely among the crowd and so the crew pressed on to their intended mooring site at Ichteghen. When they thought they were in the right area, the crew fired a Very light which was answered from the ground. Landing in the light of car headlamps, the ship brushed against some trees; the crew upset the local farmer by dropping the heavy trail rope on him and were then pulled down too fast by the groundcrew and landed in a sea of mud.

Events then went from bad to worse. The weather conditions prevented any serious flying and on October 7 a storm tore the ship from its moorings and it was completely wrecked as the crew struggled to deflate it. Now completely out of funds and with no prospect of finding a new advertising sponsor before next summer, the company was forced to cease trading and was wound up completely on October 11, 1930.

Just seven days before, on October 5, R101 had set off on its maiden voyage to India but had crashed into a hill near Beauvais, a few miles to the north of Paris, and had been destroyed by fire. It marked the end of British commercial airship development for nearly 50 years.

The remains of the AD 1 were taken back to England and put up for auction. The envelope, the material of which was worth as least £1,000, went for £12 10s and the engine for £20. The AD 2 was never completed. It was a sad end for an enterprising company which, with limited resources, attempted to find new uses for small airships at a time when there was still much enthusiasm for airships in Europe and elsewhere.

It was an experiment which was not to be repeated in England until 49 years later in 1979, when a company with the same name flew its prototype airship, the AD 500. This too had its share of problems — but this craft eventually evolved into the successful Skyship 500 of Airship Industries, thus beginning a new chapter in British airship development.

ABOVE ***A photograph taken by Capt Beckford-Ball of the AD 1 at Ichteghen, Belgium, on September 17, 1930. Note the advertising panel for British-American Tobacco's Gold Dollar Blended cigarettes (20 for 3 Francs). Within a month the airship had been wrecked in a storm and the Airship Development Company was out of business.***

KEEPING THE PEACE

THE UNITED NATIONS IN LEBANON, 1958

With the political struggle between government and rebel forces in Lebanon descending into armed conflict, in 1958 the United Nations was called upon to send observers to monitor the fighting. **JAN FORSGREN** takes the first in-depth look at the little-known operations of the Air Service of the United Nations Observation Group In Lebanon

SINCE 1948 THE United Nations (UN) has been involved in many peacekeeping operations around the world. One such operation involved despatching an observation group to Lebanon in the late 1950s. The background to the UN's involvement in this small Middle Eastern country may be traced back to the insurrection that broke out on May 8, 1958. The fighting was particularly heavy in the Lebanese capital Beirut, the northern city of Tripoli (not to be confused with the Libyan capital) and in some of the border areas with Syria. On June 11 the same year the UN Security Council resolved to send an initial small group of observers to the strife-torn country, in order to check the smuggling of weapons and infiltration of various insurgent groups.

The observation group was named the United Nations Observation Group in Lebanon (Unogil), and consisted of 591 observers, who manned 49 ground observation posts. One of Unogil's most vital components, though, was its Air Service. During its brief existence from June to December 1958, the Unogil Air Service was staffed by personnel from the air arms of Burma, Canada, Denmark, Sweden and Thailand, as well as some countries in South America. A total of 87 pilots and maintenance personnel served with the Unogil Air Service. Out of these, no fewer than 37 came from *Flygvapnet* (the Royal Swedish Air Force). The Unogil Air Service flew and maintained four Noorduyn-built Harvards, 12 Cessna L-19A Bird Dogs, two Agusta-Bell AB.47 and seven Bell OH-13E helicopters.

The story of the Unogil Air Service is a

Nine Cessna Bird Dogs and one Bell OH-13 of the Air Service component of the United Nations Observation Group In Lebanon (Unogil) share the ramp with a Middle East Airlines Douglas DC-3 (and one other DC-3) at Beirut International Airport during the Lebanon crisis of 1958.

SWEDISH AVIATION HISTORICAL SOCIETY

little-known chapter in the annals of aviation history, being limited in time (six months) and personnel strength (87). During those six months of operations Unogil and its Air Service suffered no fatalities. It may be considered to be a successful UN operation, with the objectives of the Security Council mandate — to observe and monitor rebel activity and illegal border crossings — being successfully completed.

BACK TO THE BEGINNING

Having received its formal independence from France in 1943, Lebanon is the smallest and least-populated country in the region. In 1958 Lebanon had about 1·5 million inhabitants, Palestinian refugees not included. (Lebanon had taken part in the 1948–49 war against Israel, during and after which thousands of Palestinians had sought refuge in the country.) The Lebanese population was a heterogeneous mix of 15 different religious groups, Christian (roughly 40 per cent) and Muslim (roughly 60 per cent). According to the Constitution the President was to be a Christian Maronite, while the Prime Minister had to be a Muslim. Some groups, however, were hardly represented in the political system, while still others were not represented at all.

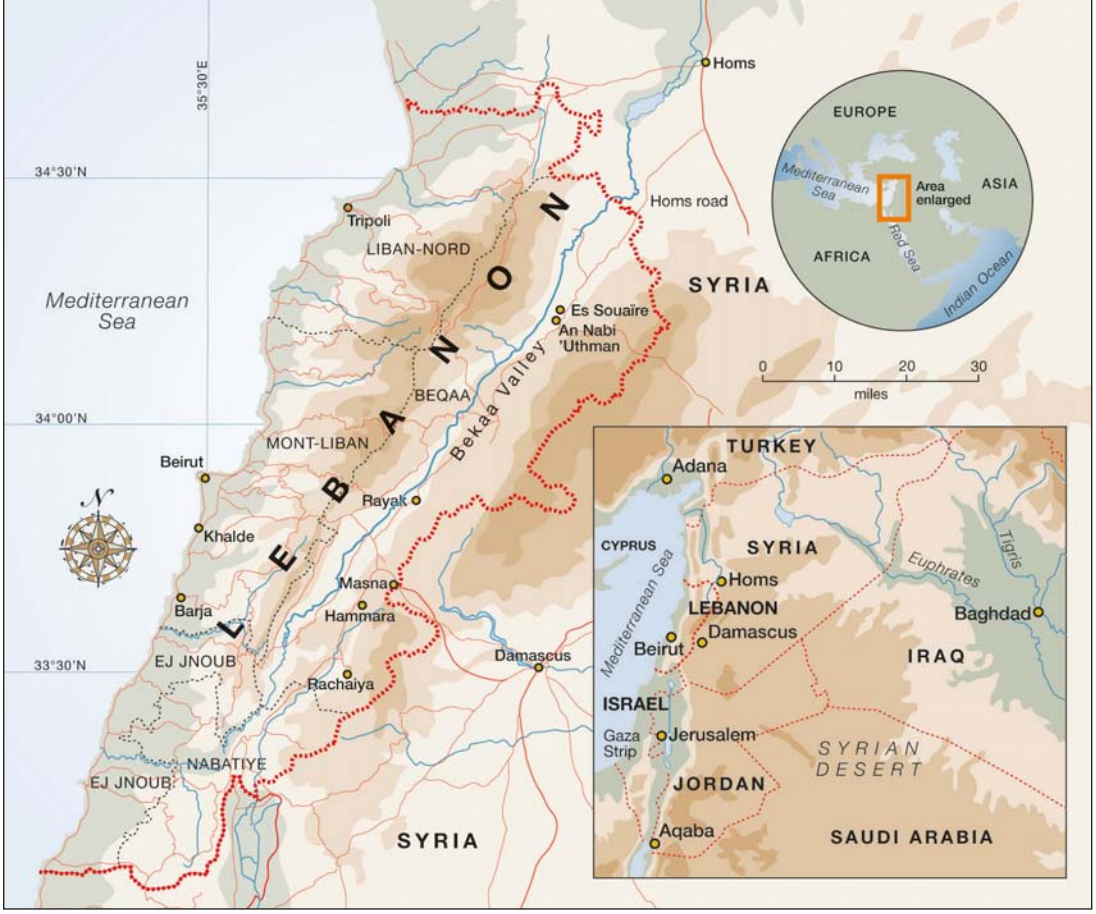
Although Lebanon was sometimes referred to as the Switzerland of the Middle East, owing to its mix of religions and friendliness towards banking and commercial enterprises, Muslim groups, which invariably belonged to the lower economic and social strata, felt a deep-rooted mistrust of the ruling political parties.

The political situation following independence was anything but calm and orderly. From 1943 until 1958, Lebanon had no fewer than 29 governments, with 11 different Prime- and Foreign Ministers. One of the leading Muslim politicians, Saeb Salam (one of the rebel leaders of the 1958 insurrection) held office as Prime Minister on two occasions; August 14–18 , 1952 (a mere five days) and May 5–August 17, 1953 (a little over three months). At times, it seemed as if the borderline between political activism and clan feuding was somewhat blurred.

On May 8, 1958, fighting between government forces and various opposition factions broke out in several parts of the country ahead of the forthcoming Presidential election. The President, Camille Chamoun, was considered to have a pro-Western stance, having supported France and Great Britain during the Suez Crisis of 1956. Initial plans by the opposition called for a general strike, which would remove Chamoun (**INSET OPPOSITE**) from power. Through a series

BELOW ***A thriving Martyrs Square, Beirut, in the 1950s. Following the collapse of the Ottoman Empire at the end of World War One, Lebanon became a French mandate and established itself as an important cultural centre in the Middle East, becoming a major tourist destination and banking haven, especially during the Persian Gulf oil boom.***

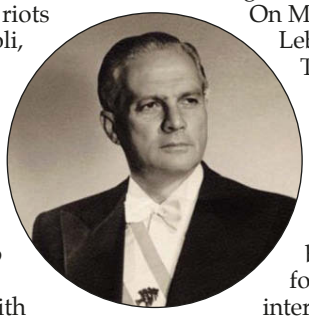
WWW.OLDBEIRUT.COM



MAP BY MAGGIE NELSON

of events, however, this general strike would turn into armed insurrection.

Throughout early 1958 several strikes and anti-government protests had taken place. During the early hours of May 8, the Editor of the anti-Chamoun newspaper *al-Telegraph*, Nasib-al-Matni, was assassinated. The news of his death triggered massive anti-Chamoun protests and riots on a scale which Lebanon had never before experienced. The worst riots occurred in the northern city of Tripoli, where, during the first three days, more than 120 protesters lost their lives. In order to suppress the protests and calm the situation, Chamoun sent a request to the United Nations, France, Great Britain and the USA for assistance.



Chamoun accused the United Arab Republic (UAR) — Egypt, Syria and Yemen — of supporting the rebels with weapons and other supplies as well as training camps. The UAR had been founded in February 1958 and was seen by many Arabs as the first step towards a united Pan-Arabic North Africa and Middle East. Despite stiff resistance from the Lebanese armed forces, the rebels quickly seized control of large parts of the country, including many rural and border areas. The latter were infiltrated by groups trained in Syria, and it was reported that Egyptian and Syrian military personnel were also involved. On May 8, military intelligence agents of Syria's *Deuxième Bureau* instigated, and took a prominent leading role in, the Tripoli riots. Three days later some 70 civilian vehicles, mostly trucks and buses, were observed on the Homs road driving westwards towards Tripoli. These vehicles were coming from Syria, carrying Syrian volunteers.

On May 13 three ships were seized by Lebanese government forces, one at Tarbaja, one at Tamur, and one off the coast of Barja. On the afternoon of the same day, several small ships sailing from the Gaza strip landed about 100 Egyptian and Palestinian commandos on the southern coast of Lebanon, these being apprehended by Lebanese forces. Other ships were spotted in international waters by Lebanese aircraft.

During May 11–14 some 2,000 Syrian commandos of the UAR's First Army (Syria) were found to be operating from various points along the border. These commandos had earlier undertaken an attack on a border post at Masna. On May 27 a mule caravan carrying howitzer ammunition was intercepted at Masna. Only the day before, some twenty 4in-calibre howitzers had been delivered to Druze rebel forces in the

SWEDISH AVIATION HISTORICAL SOCIETY

One of the four Sk 16As (Noorduyn-built Harvards) supplied by Flygvapnet for Unogil operations flying over rural Lebanon in 1958. This example, with the Unogil number 04, was serialled 16047 in Swedish service and was one of 145 Sk 16As supplied to Sweden in 1947; another 112 were acquired in 1950.

same area. On May 28 a truck carrying arms and ammunition was intercepted en route to Tripoli. Cartridges, sub-machine-guns and rifles all carried the markings and insignia of the UAR's First and Second Armies.

Syrian volunteers received the equivalent of one month's pay for each week they served in Lebanon. Even though the Syrian volunteers were the most numerous, Egyptian and Palestinian volunteers also took part in the fighting in Lebanon. During a battle near An Nabi 'Uthman on June 2–3, commands uttered in Egyptian Arabic were overheard. Syrian involvement in the Lebanese insurrection was admitted indirectly on June 11 when a former Director of Political Affairs of the Syrian Foreign Office was quoted as saying that several hundred Lebanese expatriates were infiltrating Lebanon, and that perhaps some Syrians were also fighting in Lebanon. Syria was officially not assisting the rebels, but, at the same time, was doing nothing to prevent them from reaching Lebanon. Incidentally, military officers of the UAR's First Army were overheard in café conversations being critical of Syria's role in the conflict, saying that it was not good for Arabs to be fighting Arabs. The officers were also concerned about the growing number of wounded volunteers returning to Syria.

The involvement of UAR forces in Lebanon was apparently discussed as early as February 1958, when Egyptian President Gamal Abdel Nasser visited Damascus during the celebrations of the founding of the UAR. The enthusiastic welcome awarded to Nasser in Damascus may have convinced him into committing forces to Lebanon at the most opportune moment. The fiercely pan-Arabic Nasser was said to have complained about the corruptive Lebanese influence on righteous Arabs, who were never the same again after visiting Beirut.

ENTER THE UNITED NATIONS

On June 10, 1958, a resolution draft regarding the Lebanese crisis was presented by Sweden to the UN Security Council. Two days later the resolution was approved by the Security Council with ten yes votes and one abstention by the Soviet Union. The resolution stated that an observation group — Unogil — was to be formed, its objective being to ensure that there was no illegal supply of arms or other war materiel across Lebanon's border. The first of these observers had arrived in Lebanon by June 11, having been transferred from the available UN forces at nearby Gaza.

Three Unogil Commanding Officers were appointed: former Ecuadorian President Galo Plaza Lasso (who would act as chairman and oversee the political aspects); Indian ambassador Rajeshwar Dayal (member responsible for economic matters) and Royal Norwegian Air Force General Odd Bull (executive member in charge of military matters). Unogil was divided into four sections: G 1 — personnel; G 2 — evaluation; G 3 — ground and air operations and G 4 — logistics. The Lebanese conflict was deemed to be of such importance that the United Nations Secretary-General, Dag Hammarskjöld, arrived in Beirut on June 18 in an attempt to mediate in the conflict.

The Swedish envoy to Tel Aviv in Israel wrote that although the fighting between Lebanese government forces and the rebels was

SWEDISH AVIATION HISTORICAL SOCIETY

ABOVE ***Dag Hammarskjöld, second Secretary-General of the UN, served from April 1953 until his death in an air crash in 1961. He is one of only four people to be awarded a posthumous Nobel Peace Prize.***

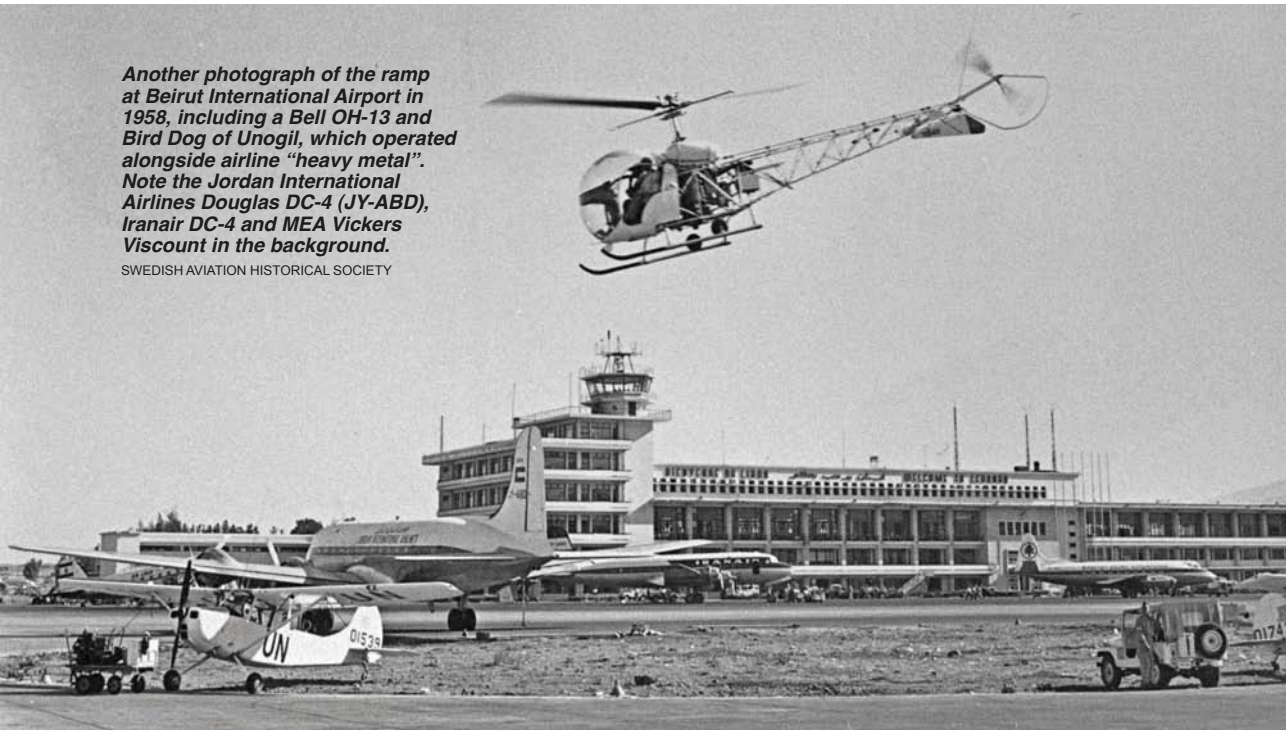
LEFT ***US Army Cessna Bird Dog 50-1742, in its overall white UN scheme, undergoing maintenance by groundcrew during its tenure with Unogil in 1958.***

widespread, it appeared to be conducted with a certain measure of careful consideration. One unwritten rule between the opposing forces seemed to be "to save the enemy so that the interesting war may continue". The insurrection was compared with the feudal fighting of ancient times between various Bedouin tribes. One of the main priorities of the insurgents was to foment unrest among the civilian population.

As most areas were controlled by the rebel forces, which were reluctant to have any UN ground observers operating in their territory, the establishment of an air service for Unogil ground observers became a matter of priority. The Lebanese government approved the use of four fixed-wing observation aircraft.

On June 20 a question regarding aircraft and personnel was forwarded to Sweden. The rapid response stated that six Sk 16As (Canadian-built Harvards) with crews could be sent to Lebanon within a week. Of these six aircraft, four were to form the nucleus of the Unogil Air Service, with the remaining two being held in reserve and as attrition replacements.

The Harvards were to be used for aerial observation duties, which included visual and



Another photograph of the ramp at Beirut International Airport in 1958, including a Bell OH-13 and Bird Dog of Unogil, which operated alongside airline "heavy metal". Note the Jordan International Airlines Douglas DC-4 (JY-ABD), Iranair DC-4 and MEA Vickers Viscount in the background.

SWEDISH AVIATION HISTORICAL SOCIETY

SWEDISH AVIATION HISTORICAL SOCIETY

Another picture of Sk 16A No 4 over the dense Lebanese forest. Amazingly, this aircraft, which started its career with the RCAF as FE992, is still flying. Resident in the UK as G-BDAM for nearly 20 years, it was bought in 2004 by a new owner in Canada, where it remains airworthy as C-GFLR.

photographic reconnaissance of rebel positions and movements. This was the first time that observation aircraft had been integrated into a UN observation force. One of the main reasons for the aircraft requirement was the mountainous terrain of eastern Lebanon, which encouraged clandestine border crossings and rebel activities, but made the work of Unogil ground observers all the more difficult. An "eye-in-the-sky" in the shape of observation aircraft would make it easier to fulfil Unogil's objectives.

HARVARDS AND HELICOPTERS

On June 25 Unogil requested that, if possible, Harvards should not be sent to Lebanon for use as observation aircraft. With the Lebanese Air Force also using Harvards to attack rebel positions, it was considered psychologically inappropriate for Unogil to use the same type. If Flygvapnet was able to send another type of aircraft, preferably Piper Super Cubs, Cessna Bird Dogs or similar, these should prove more suitable. However, if this request would mean a delay of a week or more, the Harvards would have to be sent anyway.

No Super Cubs or Bird Dogs were on charge with Flygvapnet, although a number of the former would enter service with the Swedish Army the following year. The only observation aircraft on Flygvapnet's inventory at the time were a few World War Two-vintage Fieseler Fi 156 Storchs, which were never seriously considered for Unogil service.

Apart from Flygvapnet aircraft and personnel, two Agusta-Bell AB.47 light helicopters were also loaned to Unogil. (It has been stated previously by this author that these came from the Italian Army, but this is unconfirmed.) To fly these, four Norwegian pilots arrived on June 24. In late August the two AB.47s were supplemented by seven Bell OH-13Es, including 51-13906, which had been loaned from the US Army. The helicopters were flown by Italian and Norwegian pilots. Consideration was also given to replacing the proposed Harvards with Bird Dogs from US Army stocks, these being available within a week, as Dag Hammarskjöld remained adamant that it was out of the question to use Harvards as observation aircraft. As it was very important to get any kind of Unogil aircraft to Lebanon as soon as possible, however, preparations to send the Swedish Harvards commenced anyway.

On June 26 the Swedish government decided that only four Harvards would be sent to Lebanon. As the Lebanese authorities had approved four observation aircraft, the intended reserve aircraft never left Sweden. It was originally intended to dismantle the Harvards and transport them in USAF Douglas C-124 Globemaster IIs, but, owing to a temporary lack of USAF air transport capacity, the Flygvapnet

3,420 MILES BY HARVARD

THE FLYGVAPNET CREWS consisted of Capt Sven-Erik Everstål, also the Commanding Officer of the flight, Capt Lennart Sollenberg, Lieutenants Sven Sjöstrand, Lennart Rittby, Finn Hedlund and non-commissioned officer Valter Bengtsson. The technicians were Fred Frelin, Kuno Lindholm, Stig Hedström, William Pettersson, Sven Öqvist and Sven-Erik Ytterström. While serving with Unogil, the Swedes were promoted one rank, i.e. Captain Everstål was promoted to Major etc.

The pilot's seats of the Harvards were to be fitted with specially-designed protective armour plating, which would turn out to be a wise decision. However, there was only time to fit one of the Harvards with the armour before the ferry flight, the other three being modified after arrival in Lebanon.

Before the departure of the ferry flight the Harvards were painted overall white with black anti-glare panels on the upper forward fuselage and wings. Flygvapnet insignia were retained and replaced after arrival in Beirut with blue and white UN insignia. The Harvards also received new serial numbers in black, painted on the fin. These were: 01 (Sk 16A s/n 16043); 02 (16075); 03 (16055) and 04 (16047). The callsigns for the flight south were Swedish Blue 1, 2, 3 and 4. The sole Vickers Varsity in Flygvapnet service (designated Tp 82) carried maintenance personnel and spares and was given the callsign SAFTH.

Owing to the higher cruising speed of the Varsity it usually took off after the Sk 16As, and usually arrived before the trainers at the next stop. Ground-support equipment and additional spares were flown to Beirut aboard a USAF C-124A. On June 27, following a week of intensive planning and preparations, the four Harvards took off from Wing F 1 outside Västerås. The distance between Västerås and Beirut was about 3,420 miles (5,500km) and the flight was at the time the longest formation flight ever performed by Flygvapnet personnel.

After night stops at Bulltofta, Lyon, Naples and Athens, the Swedish crews landed at Beirut International Airport at 1700hr on July 1, after 22hr of flying time. As an aside, the Swedes left Lyon early on June 28, arriving in Naples in time to watch the football World Cup Final being played back home between Sweden and Brazil. *[Sweden lost 2-5, Pelé scoring two of Brazil's handful — Ed]*

Beirut International Airport, or Khalde, became the main operational base for the Unogil Air Service. Immediately on landing Capt Everstål declared the Harvards and crews operational and ready to perform their duties. The first mission was flown the next day, on July 2. The pair of AB.47 helicopters had arrived previously, having flown 15 missions during June.

Four of the 12 Flygvapnet pilots and engineers sent to serve with Unogil beside two of the Sk 16As bound for Lebanon. The Sk 16As were supported by Flygvapnet's sole Tp 82 Varsity (s/n 82001), which was retired in 1973 and is now on display at the Flygvapenmuseum in Linköping. SWEDISH AVIATION HISTORICAL SOCIETY

SWEDISH AVIATION HISTORICAL SOCIETY

LEFT *The Cessna L-19A Bird Dogs which arrived in Lebanon from US Army stocks in West Germany were much more suitable for the observation role than the Sk 16As, which were little used from that point on. The Bird Dog had been designed from the outset as a liaison and observation aircraft, its high-wing configuration offering excellent visibility and its flat-six Continental engine proving much more economical.*

BELOW *One of the three magnificent Savoia-Marchetti SM.79 trimotors used by the Lebanese Air Force during the 1950s. This particular aircraft was returned in 1993 to Italy, where it is displayed in immaculate condition at the Museo Dell'Aeronautica Gianni Caproni at Trento. The only other survivor, also ex-Lebanese, is at the Military Aviation Museum at Vigna di Valle.*

Harvards were flown to Lebanon instead (see page 75). Initially, Lebanese authorities were reluctant to give landing permission for Flygvapnet transport aircraft carrying spares and personnel. Instead, regular airline services would be the preferred option.

On July 28 the Norwegian Government offered to send three aircraft to Lebanon, either Saab Safir primary trainers or Noorduyn Norseman light transports, along with 15 pilots and maintenance personnel. This offer was declined, however, as it had been decided to standardise on the Cessna L-19A Bird Dog, the first of which arrived in Lebanon a few days later. Norway's offer of two additional helicopter pilots and five ground observers was accepted, however.

In total, 12 Bird Dogs were transferred from US Army units in West Germany, including 50-1538, 50-1740, 50-1742, 51-4657, 51-4960, 51-7300, 51-7319, 51-7430, 51-12422 and 51-12884. The first of these arrived in Lebanon during the last days of July. Following the arrival of the Bird Dogs, the Harvards were rarely used, being flown back to Sweden during the first week of October. Two of the Harvards had not been flown for several weeks. Allegedly they were offered to the Lebanese Air Force, but were declined.

All aerial photography by Unogil crews was performed using hand-held Hasselblad cameras. The available maps of the country were old, inaccurate and lacking in up-to-date information. An attempt to alleviate this situation was made on July 12, when the UN asked Flygvapnet to supply a Douglas RB-26C Invader, or a reconnaissance aircraft of similar performance. The requested reconnaissance aircraft was to have a Swedish crew and be used for aerial mapping and surveillance duties for 3–4hr daily during a period of two to three weeks. As Flygvapnet did not operate the RB-26C the request had to be turned down. Curiously, no other reconnaissance aircraft in Flygvapnet service — piston-engined Saab S 18As or Saab S 29C jets for example — seem to have been considered. Additionally, it is probable that the National Mapping Administration's two Nord NC.701s could have been made available.

THE LEBANESE AIR FORCE

The Lebanese Air Force, also known as *Al Quwwat Aljawwiya* and the *Force Aérienne Libanaise* (FAL), operated to some extent during the conflict. The main combat aircraft of the FAL were six single-seat de Havilland Vampire FB.52s

PHILIP JARRETT COLLECTION

MIKE HOOKS COLLECTION

The first batch of six Harvards acquired by the Lebanese Air Force (FAL) in 1952 came from RAF stocks, a total of 16 being operated by the FAL until the type's retirement in 1972.

and four Vampire T.55 two-seat trainers delivered between 1953 and 1957. The FB.52s formed the equipment of No 1 Sqn, based at Khalde, while the T.55s served with the FAL Academy at Rayak.

In February 1958 five of the FB.52s were serviceable, with none of the T.55s being operational. During May and June of the same year seven additional single-seat Vampires (four FB.5s and three FB.9s) were transferred from RAF stocks. A few Hawker Hunters were also delivered, but apparently none was used operationally during the conflict.

In addition, 16 Harvards had been purchased by the FAL, 12 in 1952 and four in 1954. The Harvards were used primarily for basic training at Rayak. However, during the insurrection, they were armed with rockets and used as light attack aircraft. The FAL also had three venerable Savoia-Marchetti SM.79 three-engined aircraft, which were used for transport and maritime surveillance duties. A solitary de Havilland Dove was also on charge.

During May and June 1958 the FAL flew many missions against the rebel forces. Only a few details of these are known. On May 15 Lebanese troops, supported by ground-attack Vampires, regained some territory near the border with Syria. On the same day FAL aircraft destroyed a mule caravan carrying arms and ammunition from Syria. During June 6–8 a column of 500 men on the main road from Homs was attacked repeatedly by FAL aircraft using rockets and napalm. Regarding the effectiveness of the air strikes, Swedish envoy Åke Sjölin stated in a report to the Swedish Foreign Office, dated June 9, that the FAL had only 18 pilots, and that a certain degree of war-weariness was becoming apparent, both within the FAL and the Lebanese army. The air strikes did not seem to have any apparent effect on rebel operations. At times, poor weather temporarily hindered FAL air strikes. It is unknown whether the FAL suffered any losses during the insurrection.

According to Major Rolf Westerberg (promoted Lieutenant Colonel while serving with the UN), who in August replaced Capt Sven-Erik Everstål as Operational Commander of the Unogil Air Service, the FAL was hardly operational at all during the final months of the conflict. But by that time tension had eased considerably, mainly owing to the election on July 31 of Fouad Chehab as the new President. Chehab was the former Commander-in-Chief of the Lebanese armed forces, and widely respected by all sides.

Following the Presidential election, the fighting largely subsided. Virtually overnight, an undeclared truce became a reality. A remaining problem, however, was the continuation of hold-ups, hijackings, shootings and kidnappings in pursuit of the settling of personal vendettas, all of which continued under the pretext of rebel activities. The insurrection was seen by some as an excuse to settle old scores.

AMERICA INTERVENES

When French and British influence in the Middle East lessened following the end of the Suez conflict, American President Dwight Eisenhower wanted to counter Soviet aspirations of military and political influence in the region. The result was the Eisenhower Doctrine, adopted in 1957. According to this the USA would provide economic and military support to countries in the region. President Chamoun had already asked for American support in suppressing the insurrection and the US Navy's Sixth Fleet was assigned to intervene if necessary. Task Force 60, which consisted of two aircraft carriers — the *USS Essex* (CVA-9) and *USS Saratoga* (CVA-60)

— plus two cruisers and 20 destroyers as well as various support vessels, was despatched to the eastern Mediterranean. The decision to intervene in Lebanon came after the pro-Western Iraqi regime was overthrown in a *coup d'état* on July 14, 1958. The Iraqi King Faisal was forced to abdicate and was later executed. In its place a Soviet-oriented regime seized power. This development was viewed with considerable trepidation in Washington DC.

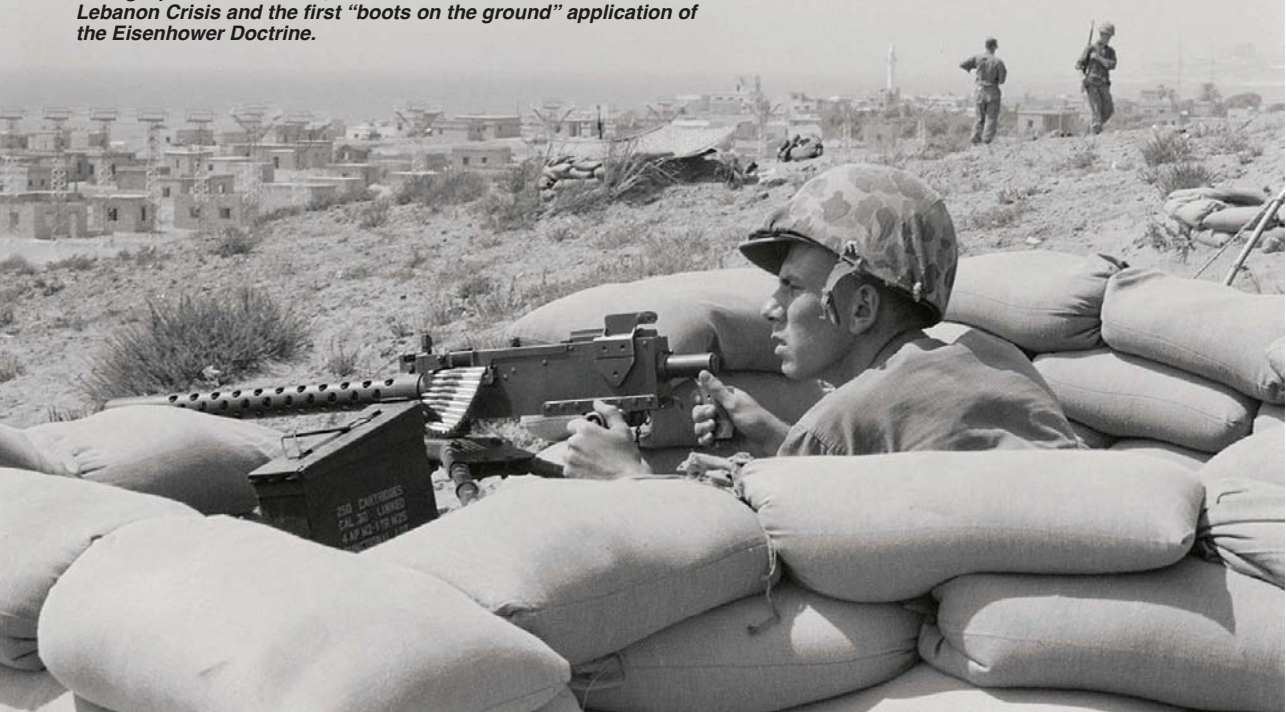
Jordan, sharing a common border with Iraq, requested the deployment of British troops to the Kingdom. Britain reacted quickly, and during the early hours of July 17 the first RAF troop-carrying transports took off from Akrotiri, Cyprus. The first of them crossed into Israeli airspace, even though no Israeli permission had been given for the flight. At first the Israelis made repeated radio calls, demanding that the RAF transport land at Lydda. When no reply was given, the Israeli authorities relented, and gave their permission for the flight to continue, issuing a formal protest against it later. The route was subsequently changed to a more southerly one, via Libya, Sudan and Aqaba. The British troops, some 2,500 paratroopers, were stationed at Amman Airport, remaining in Jordan until late October.

The small Lebanese conflict seemed to be on the verge of spreading across the entire Middle East. Following the Iraqi coup on July 14, President Chamoun summoned American ambassador Robert McClintock and demanded that American forces intervene within 48hr. As it turned out, the American response was much faster. When news of the events in Iraq became known in Beirut, rebel forces began to celebrate, firing off so much ammunition into the air that a message had to be broadcast from the mosques stating that the war was not yet over, and to save ammunition.

On July 15 a first contingent of some 1,700 US Marines stormed ashore in Beirut. The initial landings took place at 1500hr local time, ostensibly to protect the 2,500 American citizens residing in Lebanon. The American intervention was codenamed Operation *Blue Bat*. The landings proceeded swiftly, with the main objectives of securing the airport and harbour quickly being achieved. As the initial landings took place the Americans were met by confused Lebanese sunbathers. Some Lebanese troops, supported by tanks, blocked the main road into central Beirut. Although feelings between Lebanese and American forces were tense during the landings, no gunfire was exchanged. Some harassing gunfire from rebel forces was directed against the Marines securing the airport and on at least one occasion the Marines returned fire. During the first 20 days, US Navy aircraft flew a total of 3,020 sorties in support of the landings.

American operations continued until October 27, when the last American troops departed Lebanon, Task Force 60 having withdrawn in the last week of August. There was no co-operation between the American forces and the Unogil observers. The former's military presence worked as a deterrent in support of the Lebanese

A US Marine takes position in a foxhole on the outskirts of Beirut during Operation* Blue Bat, *America's intervention in the 1958 Lebanon Crisis and the first "boots on the ground" application of the Eisenhower Doctrine.



SWEDISH AVIATION HISTORICAL SOCIETY (SAHS)

ABOVE ***Bird Dog 51-12884 in Unogil service over Lebanon. Note the prominent whip antenna on the cabin roof.*** **LEFT** ***A member of the Unogil team performing observation duties from a Bird Dog. The work was technically just observation, but Unogil aircraft were often subjected to fire from below.***
GÖRAN KAIJSER VIA SAHS

government whereas Unogil was a neutral and impartial observer. According to some Swedish diplomatic reports, some American troops showed a flippant and negative attitude towards Unogil and its operations.

UNOGIL AIR OPERATIONS

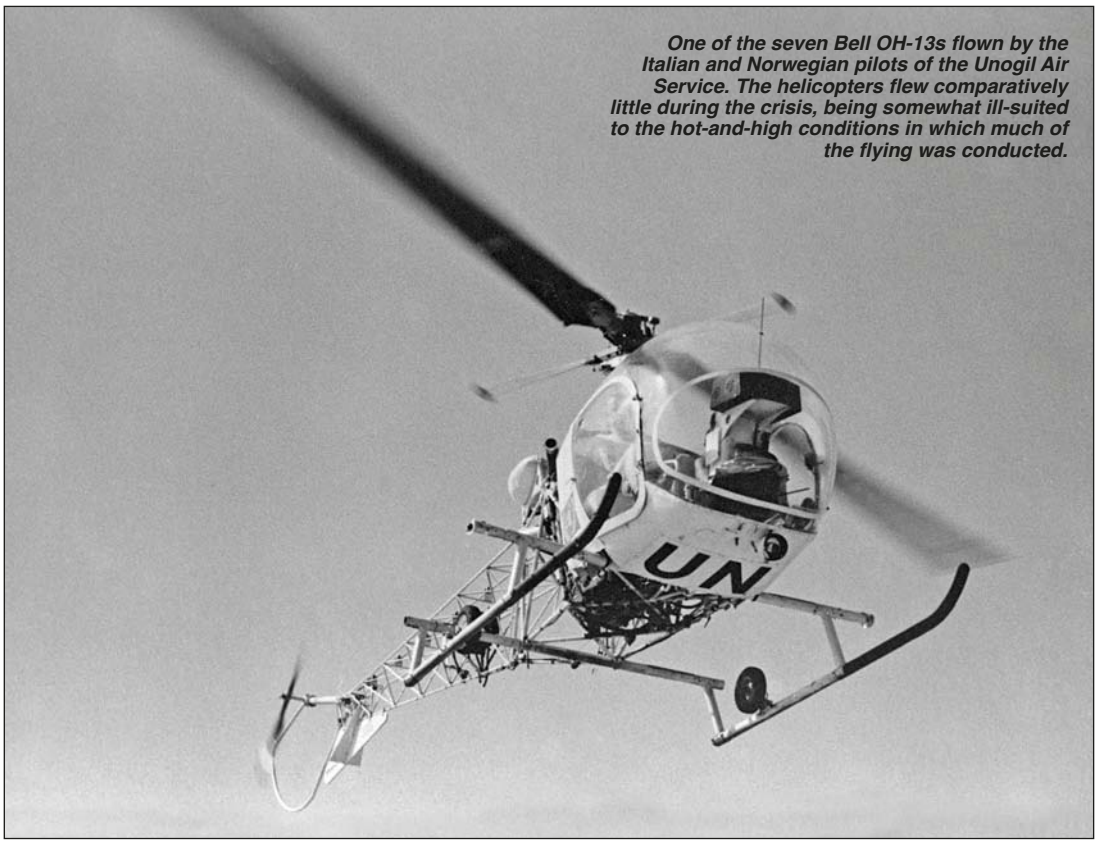
The Unogil Air Service operated extensively during the UN mandate. A continuous 24hr aerial watch was maintained over rebel-held areas; and transport, liaison and training sorties were also flown. Between eight and ten aerial observation sorties were flown each day, with a typical sortie lasting about 3hr. This was accomplished without any pilot having to fly more than 45hr per month. Aircraft and helicopters also had to be kept available for emergencies and other duties.

The Cessna L-19As were far better suited to the aerial observation role than the Flygvapnet Harvards. Having been designed from the outset as an observation aircraft, the high-winged Bird Dog gave the pilot and observer a virtually unobstructed view of the ground.

Although the Flygvapnet pilots and maintenance personnel had no previous experience with the Bird Dog, few problems were encountered in learning how to operate the type. Apparently, no US Army instructors were available to assist the Unogil Air Service personnel in handling the Cessnas, but the aircraft were found to be easy to fly and maintain. As well as the Swedes, several Danish pilots also flew the Cessnas.

Although most of the aerial observation patrols were mundane and uneventful, the risk of being hit by small-arms fire was always present. The Unogil Air Service aircraft and helicopters were fired upon on 59 occasions, but only nine of these resulted in damaged aircraft. Two pilots were injured, although neither seriously. On October 22 Sgt Bo Carlsson was hit in the back by a rifle bullet, and on another occasion Sgt B-O. Joelsson was hit in the face by shrapnel. In general, only the rear fuselage of the aircraft was hit, with a few exceptions.

During one sortie on August 8, a Harvard, flown by Lt Finn Hedlund, was struck in the starboard wing fuel tank by several bullets, with others passing through the (thankfully empty)



One of the seven Bell OH-13s flown by the Italian and Norwegian pilots of the Unogil Air Service. The helicopters flew comparatively little during the crisis, being somewhat ill-suited to the hot-and-high conditions in which much of the flying was conducted.

SWEDISH AVIATION HISTORICAL SOCIETY

rear cockpit. This turned out to be the last operational Unogil Air Service flight with the type. On another occasion, a radio was destroyed by a direct hit, while on another sortie an engine was damaged so badly by small arms fire that upon examination after landing it was deemed a total loss.

BIRD DOG DOWN

One incident which could well have ended in tragedy occurred on July 31. While on a routine patrol in a recently-delivered Bird Dog, Lt Lennart Rittby had to make a forced landing near the village of Hammara, which had a partly Palestinian population. Rittby had to spend an uncomfortable and anxious night at Hammara but was well treated. Guards were placed by the Cessna, but during the night these were driven away by other rebels from another village. These rebels were looking for the "American aviator". They were told that the pilot had been taken to another village to the south, Rachaiya. The following day Rittby was released from rebel custody and returned unharmed to UN forces. Rittby was later told that if he had landed at the village occupied by the rebels, it was unlikely he would have made it through the night. This was explained by an age-old rivalry between the two villages. As the propeller of the Bird Dog had been slightly damaged during the forced landing, the aircraft was dismantled and brought back to the airport at Khalde by road. The damage was easily repaired, and the L-19A was returned to service within a few days. The cause of the forced landing was found to have been contaminated fuel.

The Commanding Officer of the Unogil Air Service, Rolf Westerberg, forbade his pilots to fly lower than 650ft (200m) in order to reduce the risk of being hit by small-arms fire. Because of the heat some pilots chose to wear sandals instead of regular heavy shoes. This practice was also forbidden. If a pilot wore standard issue shoes he stood a better chance of reaching friendly territory should he be forced to make a forced landing in rugged, inhospitable terrain.

Unogil observers were able to establish both confidence and a good working relationship with the opposing sides in the conflict. On August 9, in a report to the Swedish Foreign Office, Åke Sjölin wrote that Unogil had a much better grasp of the opinions and spirit of the

rebels than the Lebanese authorities. The somewhat waspish response from the Lebanese government was that Unogil was in the country to observe, not to conduct opinion polls. The government also accused some Unogil observers of fraternising and partying with rebel leaders.

On August 15 it was decided to expand Unogil to 200 observers and the Air Service to 16 aircraft, including six night-reconnaissance aircraft and seven helicopters. Regarding the former, no specific type was mentioned, and in the event no such aircraft were taken on charge. Neither the Harvards nor the Bird Dogs could be used efficiently on night reconnaissance sorties.

UNOGIL'S WHIRLYBIRDS

The AB.47s and OH-13Es suffered from poor serviceability, as well as limited performance in hot-and-high conditions. One frequent problem was the throwing of stones by children into the tail rotor when a helicopter landed near a village. On two occasions the tail rotor shattered into fragments, to the great delight of the children. This made many of the pilots wary of landing at local villages. On both occasions, local rebel leaders apologised and assisted in returning the helicopters to Khalde. As spare parts, including tail rotors, were not always available or delivered on time when needed, this meant that the helicopters remained grounded for a longer time than necessary.

On August 31, as a helicopter was about to land at a village, it was fired upon by a trigger-happy villager. He was disarmed by other villagers and severely beaten, an incident which may serve as an indication of the level of trust and confidence in which Unogil was held by large parts of the local population.

On November 26 Unogil, along with its Air Service, was formally disbanded. The last Swedes returned home shortly before Christmas. The Bird Dogs were all returned to the US Army. The Harvards had been flown back to Sweden in early October. The AB.47s were returned to Italy, but the fates of the OH-13Es are unclear. Major Westerberg attempted to donate at least one of the OH-13s to the FAL. However, the highest-ranking FAL officer Westerberg could find was a hesitant lieutenant. When offered a fully operational helicopter, free of charge, the FAL lieutenant simply replied "Well, what do you want from me?"

The cost of the Unogil observation mission was US$3,697,742, of which about US$155,000 covered the leasing of aircraft and helicopters. Following the American landings in Beirut on July 15, Unogil observers served as an important counterweight to American forces. For the Swedish personnel who served in the Unogil Air Service, it was a source of valuable practical experience in peacekeeping operations and international co-operation. Having said that, without the logistical support of the Americans, the Unogil Air Service would have been unable to deploy to Lebanon as quickly as it did. While the USAF assisted with transport capacity, the US Army provided the vital aircraft.

The human cost of the insurrection was estimated at around 6,000 killed, and an untold number wounded. The official count was 1,364 killed, but only Lebanese casualties reported to the authorities were included in this number. Many of those killed on the rebel side, including Egyptian, Palestinian and Syrian volunteers, were never reported. Even if the lasting value of Unogil is arguable, it may be said that the Lebanese political situation remained relatively stable until 1975, when a civil war broke out. This proved to be far more costly in human and material terms than the events of 1958, in which aviation had played a vital, if understated, role in keeping the peace.

ACKNOWLEDGMENTS

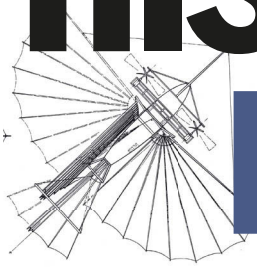
The author wishes to thank the late Rolf Westerberg and Göran Kaijser for their invaluable help with this feature. TAH *would like to thank www.oldbeirut.com*

UNOGIL AIR SERVICE OPERATIONS IN 1958

	Fixed-wing aircraft		Helicopters		Total	
	Sorties	Hours	Sorties	Hours	Sorties	Hours
June	—	—	15	73	15	73
July	114	274	56	86	170	360
August	156	374	54	120	210	494
September	225	610	70	171	295	781
October	209	570	93	190	302	760
November	154	360	30	72	184	432
Total	**858**	**2,188**	**318**	**642**	**1,176**	**2,830**

The four Flygvapnet Sk 16As were used on 70 sorties, accumulating 152·12 flight hours

HISTORY or HOGWASH?



In March 2013 claims re-emerged that experimenter Gustave Whitehead flew before the Wright Brothers — and this time the controversy even reached the newspapers, TV and the Connecticut Senate. So is there anything in it? **MICK OAKEY** reports on the affair, and on how it highlights the question of what we accept as historical fact . . .

HERE WE GO again, I thought earlier this year, when for the umpteenth time the shoots of one of aviation history's persistent perennial weeds started unfurling. Time for the park-keepers to reach for the glyphosate and, with luck, kill it off once and for all.

Within days, however, that "weed" — the contention that the Wright Brothers had been preceded by German-born, USA-based experimenter Gustave Whitehead (**RIGHT**) in achieving powered aeroplane flight — was spreading its burgeoning tendrils across the world and rapidly becoming ineradicable. This had never happened before, despite the best efforts of its proponents to cultivate it, so why the sudden spurt? Had some new growth factor emerged, some new piece of evidence that would allow it to outcompete the Wrights for the sunlight of recognition?

THE USUAL SUSPECTS

Before seeking answers to these questions, we need to look at the back-story. Despite the overwhelming consensus among aviation historians that 110 years ago, in 1903, Wilbur and Orville Wright were the first to achieve powered, sustained and controlled heavier-than-air manned flight, there have been rival claims on behalf of other pioneers. Russia's Alexander Mozhaiskii, France's Clément Ader and New Zealand's Richard Pearse, among others (including Whitehead), have all been the subjects of such claims, generally for reasons of blinkered nationalism or vested interest. All have been tested in the court of specialist peer-review and found wanting.

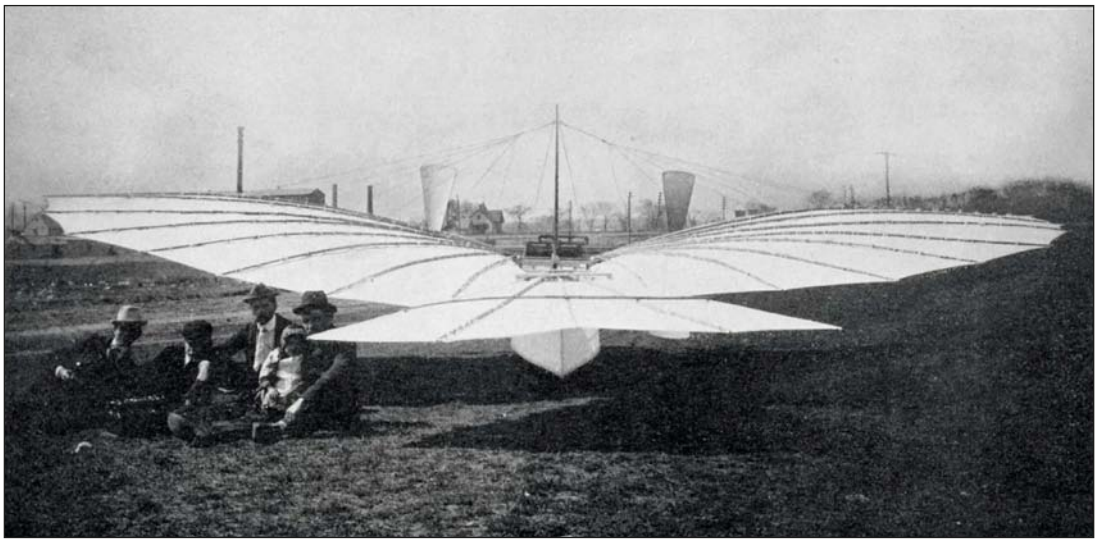
In Whitehead's case, his supporters claim that he flew (a) for half a mile in a steam-engined aeroplane in Pittsburgh, Pennsylvania, in spring 1899; (b) for at least half a mile (and possibly 1½ miles, and up to four times) in his acetylene- or steam-engined "No 21" monoplane at Bridgeport, Connecticut, in August 1901; and (c) for two and seven miles respectively in two separate flights of his kerosene-engined "No 22" monoplane over Long Island Sound in January 1902.

If he really achieved all these flights, why has he remained so obscure until now? There are several reasons.

First, evidence, or rather the lack thereof: there has simply been no conclusive, reliable record.

Secondly, likelihood: although Whitehead built numerous models and full-sized aircraft, and demonstrated glider-flying successfully in 1904-10, none of his powered aeroplanes appears to have been practical. There is no surviving picture of his No 22 of 1902, but each successive aircraft up to and including his final and unsuccessful project, a 60-rotor helicopter of 1911–12, seems to have differed radically from its predecessor, strongly suggesting that he never found the "magic formula" for flight. As Wright historian and replica-builder Nick Engler says, "[Whitehead] tells us he is getting wonderful results from each new airplane and engine; then he discards them, never flying them again". This contrasts sharply with the Wrights, whose steady, incremental, consistent progress through gliders to their powered 1903 Flyer and beyond is clearly documented.

Thirdly, what horseracing aficionados and



ALL IMAGES PHILIP JARRETT COLLECTION UNLESS NOTED

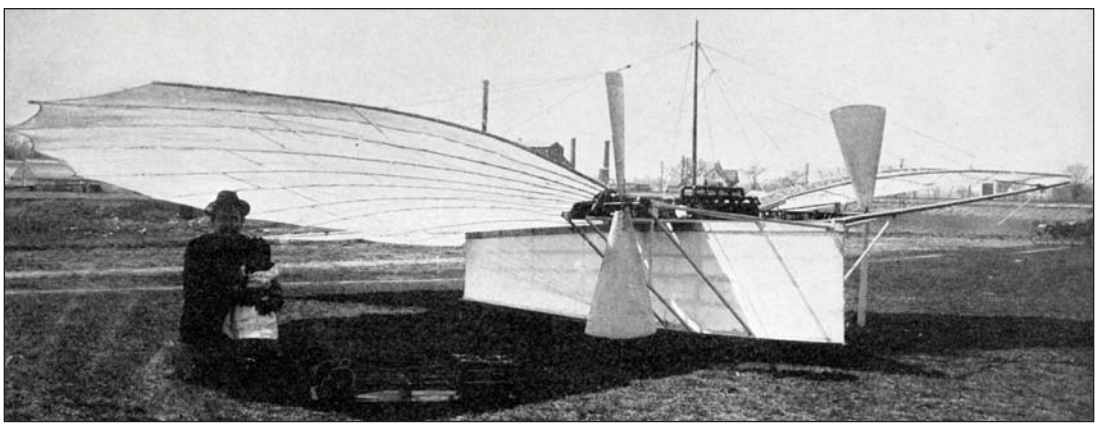
policemen call "form": Whitehead himself made extravagant claims about what he had supposedly achieved, but subsequently changed his story or pleaded misunderstanding when challenged. That on its own does not mean he did not achieve powered flight — plenty of people who scored other notable firsts did so despite lying, or manipulating, or being impossible to work with, or self-promoting beyond the bounds of honesty — but when added to the other factors the case for his primacy collapses. Certainly any suggestion that he flew on any of the dates noted above, other than inside his own head, is at odds with the following item from the first issue of *The Aeronautical World* (Vol 1 No 1, August 1, 1902, page 21):

"Aerial Machines for $2,000 Each
"A man in Connecticut named Weiskopf [sic], under the firm conviction that he has theoretically solved the problem of flight, is preparing to accept orders for machines. An aerial machine to carry six persons he estimates he can manufacture and sell for $2,000. The machines, which are to be furnished with immense wings, are to be propelled by steam. He claims to have a good financial backing and that his model travelled at the speed of 45 miles an hour. It appears that Mr Weiskopf has Anglicized his name to Whitehead."

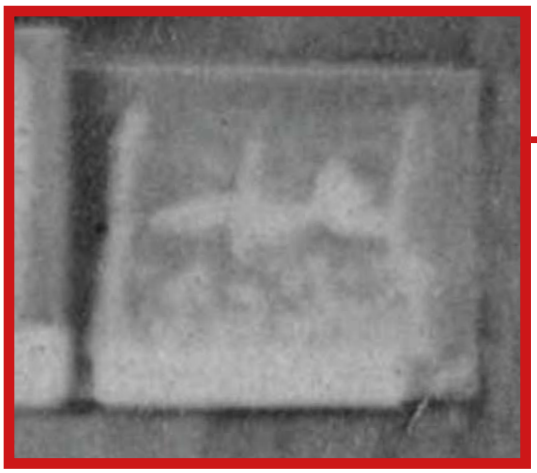
Note especially the words "theoretically" and "model". So why has Whitehead come back to prominence, and why is *The Aviation Historian* devoting space to him in its pages?

NEW EVIDENCE?

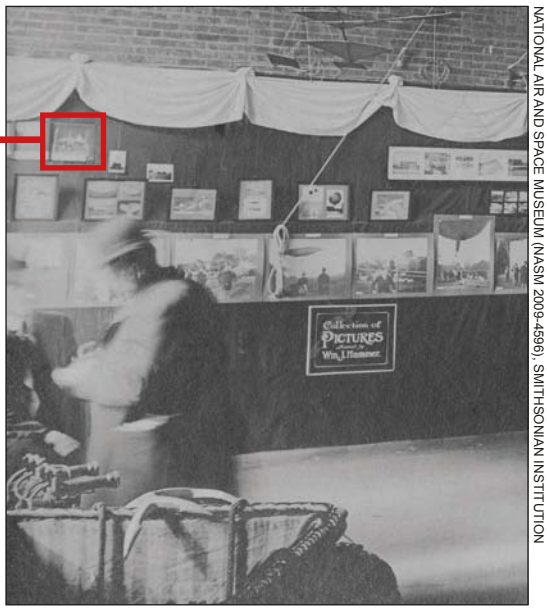
It is partly because hitherto little-known Australian researcher John Brown, a project manager for a company developing a "roadable" aircraft in Germany, has put forward what he believes is new evidence showing that Whitehead did indeed make the claimed flights in 1901. His argument, expounded on his website at www.gustavewhitehead.com, revolves around his theory that a



TOP & ABOVE ***Rear and front views respectively of Whitehead's bat-winged No 21 monoplane of 1901, in which it is claimed he flew on August 14, 1901. A plan-view drawing of the aircraft, by Björn Karlström, is incorporated in this article's heading on the opposite page. The original of the view*** **ABOVE,** ***in which Whitehead poses with his small daughter Rose, was retouched at some point to remove a tree in the background behind the port wing.***



BLOW-UP SUPPLIED BY JOHN BROWN



NATIONAL AIR AND SPACE MUSEUM (NASM 2009-4596), SMITHSONIAN INSTITUTION

RIGHT ***A detail from the image on the opposite page, with*** **ABOVE** ***the massively enlarged photograph-within-a-photograph which, according to John Brown, depicts Whitehead's aeroplane in flight in 1901. Brown offers an analysis of the picture on his website.***

photographic print pictured among other images on a wall in an Aero Club of America (ACA) exhibit in New York in early 1906 shows the Whitehead No 21 aircraft in full flight in 1901. This is not all; Brown also cites an original eyewitness report and "more than 100 contemporary news reports".

An impressive body of evidence, then? Well, no. The ACA photograph-within-a-photograph has been massively enlarged and its contrast has been increased. We reproduce it **ABOVE**; we do not have the space to repeat Brown's detailed analysis of it, which is freely available on his website. Brown tells *TAH*, "The photo I found purports to show Whitehead in sustained, powered flight in 1901. However, it had to be enlarged more than 3,000 per cent because it was a photo of a collection of Whitehead pictures at an aviation exhibition and is too blurred to identify many details. It is proffered because three contemporary journalists saw it up close and stated it showed Whitehead in flight in his 1901 machine. But Wright biographers alleged all the reporters were 'lying'. It appeared to be a high-wing monoplane with a central mast, flying at the height stated in the reports [20ft]."

We urge readers to decide for themselves whether that is indeed what the photograph shows, and whether the analysis is sound. Meanwhile it should be pointed out that, despite Brown's assertion that three journalists said the image "showed Whitehead in flight in his 1901 machine", what the source article (in *Scientific American*) actually says is that the image depicts "a large bird-like machine powered by compressed air" — it does not say that it was manned, and the use of compressed air suggests it was a model.

Regarding the 100-plus press reports, Brown tells *TAH*, "Yes, I found more than 100 contemporary news reports about Whitehead's pre-Wright flights. But only the original report has probative value because it is by an eyewitness. I cite the others because Orville Wright had argued the previous lack of known news articles somehow 'proved' Whitehead didn't fly."

Surely an eyewitness report is always reliable? Again, no. In this particular case, published in the *Bridgeport Herald* of August 18, 1901, and attributed to the paper's managing editor, Richard Howell, the article's headline includes a depiction of four witches manœuvring their broomsticks through the word "flying", which suggests editorial mischief and a spoof story (see panel on page 86). Howell names two other eyewitnesses beside himself, but later one of them (James Dickie) claimed not to have been present and that he believed the entire story "was imaginary, and grew out of the comments of Whitehead in discussing what he hoped to get from his 'plane". As for the many other press reports, the newspapers have always picked up and repeated stories from other papers, without always being too scrupulous about their veracity — so 100 reports are no more believable than one report; they are merely more numerous.

ENTER *JANE'S ALL THE WORLD'S AIRCRAFT*

If you are still with me, then congratulations; and I expect you are asking why on earth *TAH* is devoting several pages to the highly questionable theory that Mr Brown is promoting.

The sole reason is that, extraordinarily, Paul Jackson, the editor of the Development & Production

ABOVE ***The photograph upon which John Brown has focused. It was taken at an Aero Club of America exhibition in New York in early 1906. On the wall below and beyond the suspended (and rather ragged) Lilienthal glider are several images which include, at far left, some recognisable photographs of Whitehead aircraft. Also of interest, although not directly relevant to this article, is the object at lower right: it is the crankshaft and flywheel from the engine of the original 1903 Wright Flyer.***

NATIONAL AIR AND SPACE MUSEUM (NASM 2009-4596), SMITHSONIAN INSTITUTION


AUG 18, 1901 SUNDAY HERALD.

WHITEHEAD'S FLYING MACHINE SOARING ABOVE THE TREES

THE BRIDGEPORT *HERALD* — A RELIABLE SOURCE?

WHEN CONSIDERING primary source material, it can be vital to examine it in context, not just in isolation. In the case of the* Bridgeport Sunday Herald, *such an approach is illuminating. The story* ABOVE, *referred to in this article, appeared on page 5 of the August 18, 1901 edition. Research in the paper's archives shows that the "page 5 story" was often sensational and, as early-aviation historian Nick Engler says, "walked the line between fact and fancy". Five weeks earlier the page 5 slot was home to* The Dog Man of Windham, BELOW, *a story about a Yeti or Bigfoot seen in Connecticut's woods. Other stories that summer described* The Great White Shark of the Lexington Wreck, *which attacked divers searching for treasure in a sunken ship, and, just a week after the* Flying *story,* The Woodbury Kleptomania, *about a woman who stole rare plants and chickens.


JULY 14, 1901 SUNDAY HERALD.

THE DOG MAN OF WINDHAM

PARADISE

CELEBRATE WHO H

THE HOME OF THE DOG MAN

THE DOG MAN OF WINDHAM

Capt. Bond

CAPT. BON

component of *Jane's All The World's Aircraft (JAWA)* — that long-established bible of aviation reference (albeit not aviation *history* reference) — chose, in March this year, in the foreword to its milestone 100th edition, to place his reputation and that of *Jane's* on the line by (a) summarising Brown's research, (b) describing it as "meticulous", and (c) accepting it as fact, concluding with the snappy slogan "The Wrights were right, but Whitehead was ahead". This endorsement of bad pseudo-history in a normally highly-respected aviation publication simply must not, in *TAH's* view, be allowed to go unchallenged.

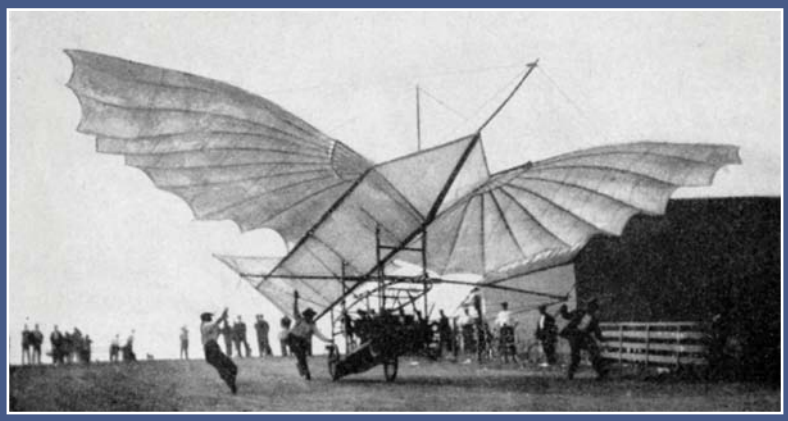
In fairness to Mr Jackson, we all make mistakes. I speak from experience, as an aviation-history journalist and editor of 30 years' standing. Sometimes, those of us who write or edit will end up committing those mistakes (through error or misjudgment) to print, where they squat indelibly upon the page forever. From this unassailable position they glare at us balefully, making us squirm every time they catch our mind's eye. This usually makes us very keen indeed to avoid making further such mistakes.

In this instance the editor of *JAWA* appears to have fallen, hook, line and sinker, for Brown's hypothesis — perhaps in a weak moment, given the occasion of the "100th foreword". It seems to be a classic case of an editor, looking for the chance to say something eyecatching and sensational on a momentous occasion, falling victim to someone with an axe to grind and coming a cropper.

Journalists need to be sceptical. And if they are not when they start, they soon learn to be, because it is all too easy to find oneself manipulated. As philosopher Denis Diderot (1713–1784) said, "What has not been examined impartially has not been well examined. Scepticism is therefore the first step toward truth". One way of being sceptical is, when confronted with an argument presented on a plausible-looking website, to wonder whether it really merits the overturning of many decades of well-informed scholarship.

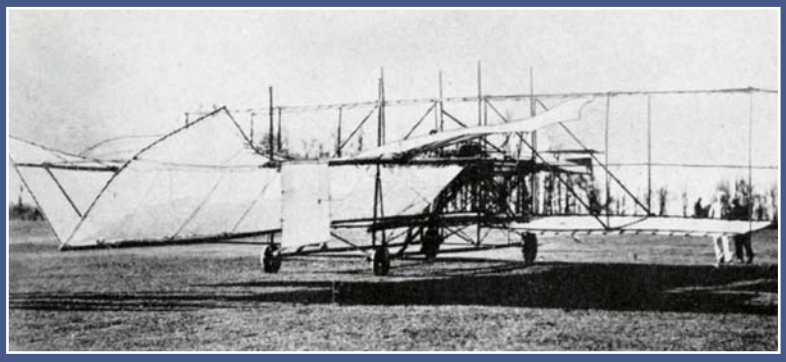
It is all about being as accurate and careful as possible. In his book *What is History?* (London; Macmillan, 1961), Professor E.H. Carr — once a journalist himself, serving as assistant editor of *The Times* during 1941–46 — quotes Housman's remark that "accuracy is a duty, not a virtue".

Like Whitehead, Jane's has form: in 1982 New Zealand newspapers reported that J.W.R. Taylor, the then editor of *JAWA*, was to give "official recognition" that their local hero Richard Pearse "was the first man to fly an aircraft", and was to publish this in a *Jane's History of Flight* to mark the 75th anniversary of *JAWA*. As renowned early-aviation historian and *TAH* Editorial Board member Philip Jarrett says, "It appears that

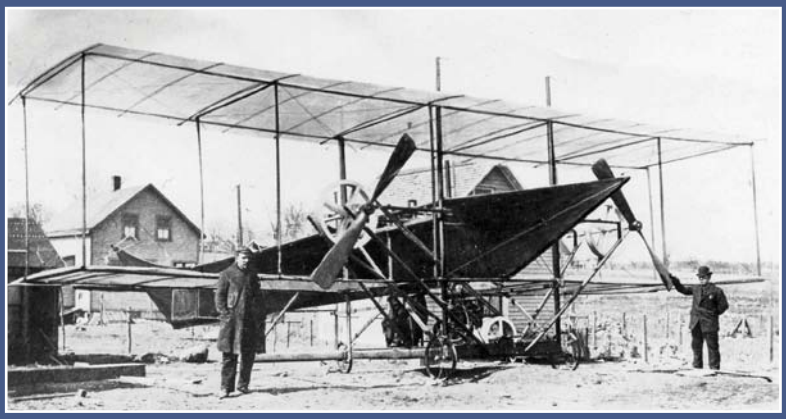


This page features a selection of Whitehead types:

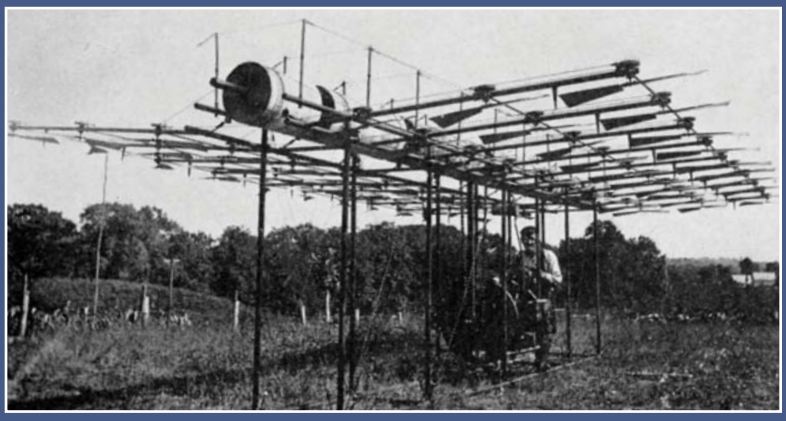
LEFT *His large glider of 1902–05, often referred to as the "Large Albatross" (there was also a smaller version), being tested at Stratford, Connecticut, in about 1904. It had foldable wings and could be towed into the air behind a car. In 1905 Whitehead filed a patent for this design which was granted in 1908 (No 881,837).*



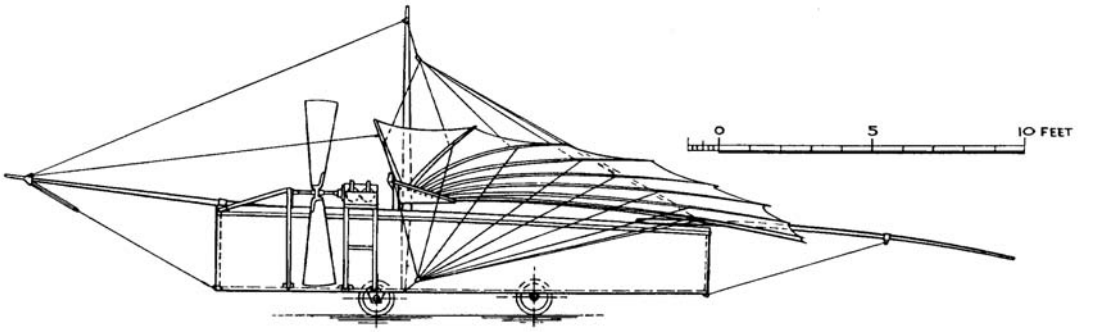
LEFT *The Whitehead-Beach aeroplane of 1908, constructed at Tunxis Hill, had flatplate-section biplane main wings supplemented by batlike monoplane wings at mid-fuselage. White Japanese silk was used in the wings. A lever controlled the rudder and elevated the batlike wings.*



LEFT *Another incarnation of the Whitehead-Beach biplane, built for Stanley Yale Beach, son of the editor of* Scientific American, *with shallow camber on the wings and without the supplementary mid-fuselage wings. Note the belt drive from the lower chassis-mounted engine to the twin propellers.*



LEFT *Whitehead at the wheel of his 60-rotor helicopter of 1911–12, his last aircraft design. It was built for Lee S. Burridge, the founder and president of the Aeronautical Society of America. Contemporary reports stated that a 75 h.p. engine powered the rotating drum which ran the length of the machine, the rotors being driven by the drum via a pulley system.*



ABOVE ***A side-elevation drawing of Whitehead's No 21 aircraft by Björn Karlström, showing the engine position and the bowsprit-and-kingpost bracing system. Note the complete lack of fixed or movable vertical tail surfaces.***

something peculiar comes over *JAWA* editors when anniversaries occur".

History depends for its basis on sources which the historian believes to be reliable. Brown apparently believes his sources are reliable, as, presumably, do any supporters he may have; but the rest of the informed aviation-history world does not.

Sadly *Jane's* is not the only prominent body to have fallen for the "new evidence". In early June 2013 Brown's "revelations" prompted the Senate of Bridgeport's home state of Connecticut to pass a bill to honour Whitehead instead of the Wright brothers on the state's "Powered Flight Day". As business historian John Steele Gordon says, "Among the prices we pay for democracy are legislatures doing silly things".

Brown claims he has no axe to grind, saying that he happened upon his "evidence" while researching roadable aircraft. But for someone with no ulterior motive, he is very selective in his choice of which facts to use and which to dismiss. Carr again: "Facts . . . are like fish swimming about in a vast and sometimes inaccessible ocean; and what the historian catches will depend, partly on chance, but mainly on what part of the ocean he chooses to fish in and what tackle he chooses to use — these two factors being, of course, determined by the kind of fish he wants to catch".

The check-and-balance which moderates historic fact-fishing is peer review: any new historical postulation is open to scrutiny by other historians before it becomes accepted. And this is exactly what has happened with Brown's Whitehead hypothesis, even though *Jane's* has not (at time of writing) chosen to change or add a footnote to its 100th foreword as published on its website.

THE HAZARDS OF ONLINE DISSEMINATION

All this highlights the very real threat that the internet poses to the promulgation of "wholesome" as opposed to "toxic" history. Anyone can set up a convincing-looking website, claiming whatever they want as fact, and the disinformation it contains is instantly accessible worldwide. It has never had to undergo the filter of the authoritative editor or publisher saying, "hang on a minute, I don't think this is kosher". In journalism and research, one now accepts that the web-genie is out of the bottle; and one therefore tends to be very careful about what to take as gospel from online sources. The public is less cautious, not least because of the ubiquity of spin and dissembling among political and other leaders who should be trustworthy, and the rise of instant information-and-judgment through such channels as Twitter. As British commentator Giles Wood wrote recently, "Information wars are rife. The electronic age has incubated a new entity — not a consumer but a 'prosumer', someone who shops around for the information he prefers to believe, because he no longer respects what authority has to tell him". Brown takes exactly that "prosumer" approach, claiming: "These days, people don't rely on editors or historians. If they want to know what happened in 1901, they simply read 1901 papers online".

Ouch! That puts me and my colleagues in our place, then. But Brown seems to miss the fact that newspapers were no more reliable in 1901 than they are now. This is not to denigrate newspapers, which perform a vital function in any free society; but think about this: we aviation devotees often look at newspaper or TV reports of, for example, historic-aircraft crashes, and spot the phrase, "Eyewitnesses on the ground report seeing the pilot fighting with the controls to avoid crashing on a school/house/playground etc". No they didn't, in general: it's just a lazy cliché inserted to titillate people while comforting them in equal measure. And when newspapers get things wrong in areas about which we do know something, what are they getting wrong in stories about which we are less well-informed and therefore cannot challenge easily?

It should be noted at this point that, in addition to his Whitehead website, Brown was, in June 2013 as these pages went to press, in the process of setting up another website, www.wright-brothers.com. In a recent e-mail to Britain's leading authority on pre-World War One aviation, Philip Jarrett, Brown says "I'm not an expert on the Wrights", so it will be interesting to view that website's content when it becomes available and

see if it encourages visitors toward any particular point of view . . .

So, is history immutable? Will the Wrights always retain the crown as being the first to fly an aeroplane? No to the first question, and most likely yes to the second. History is not fixed; it evolves. As Prof H. Butterfield says in *The Whig Interpretation of History* (1931), "For the historian, the only absolute is change". Carr elaborates: history is "a constant process of interaction between the historian and his facts, an unending dialogue between the present and the past"; and "Our sense of direction, and our interpretation of the past, are subject to constant modification and evolution as we proceed". As to whether the Wrights will wear their crown in perpetuity: if compelling and irrefutable new evidence should emerge to show that anyone preceded their achievement, then aviation historians and *The Aviation Historian* will bow accordingly. But we are not holding our breath.

TAH is not alone in this. In the USA Tom Crouch, senior aeronautical curator at the Smithsonian Institution's National Air & Space Museum and a leading early-aviation historian, says, "Unlike the case of Gustave Whitehead, a careful investigation proved that Wilbur and Orville Wright had accomplished all that they claimed, and more". He adds, "the [Whitehead] decision must remain: not proved". Meanwhile historian and replica-builder Nick Engler says of Whitehead's various claims, "a pattern emerges. Whitehead claims success; his boasts garner him contracts; but he is unable to deliver on his promises. Then the cycle repeats". In the UK, Philip Jarrett says Brown "has yet to address major questions regarding his assessments, assumptions, misleading statements and unreliable 'research'".

What all the above boils down to is this: we simply don't know what Brown's central photograph depicts; nor when it was taken (other than before 1906); nor where. Are we then to accept it, along with his other arguments, as evidence that Whitehead flew before the Wrights? The answer clearly has to be no. Thus the weed gets stamped on again — but, as long as there are people around the world who prefer the tempting juice of conspiracy theory to what they see as the dry dust of plain old history, doubtless it will be back.


THE
AMERICAN INVENTOR
Devoted to the latest Developments of the Arts and Sciences, and to the American Inventor.
WASHINGTON, D. C., APRIL 1, 1902.
Letters to the Editor
THE WHITEHEAD FLYING MACHINE.

ABOVE ***In this letter printed in*** **The American Inventor** ***of April 1, 1902, Whitehead claimed to have flown for two miles and seven miles in his "No 22" monoplane, of which no image is known (the No 21 is shown here).***

ACKNOWLEDGMENTS

The author wishes to thank Nick Engler, Philip Jarrett, Tom Crouch and John Brown for their assistance in the preparation of this article

JENNIFER GRADIDGE VIA PHILIP JARRETT

ABOVE ***In the 1980s–90s two flying "replicas" of the Whitehead No 21 were built, one in Germany and this one, designated "No 21A", in the USA. Although both were flown, structural and aerodynamic differences, plus the use of modern powerplants, mean that they cannot be regarded as proof that the original aircraft was capable of flight.***

The Latvian Gladiators, probably at Riga-Spilve. The fighters were paid for by funds raised through a special National Lottery, the aircraft being presented at a ceremony on August 12, 1938.

BEFORE & AFTER

ROGER TISDALE and ARVO VERCAMER continue the series in which they profile both the original and new markings of aircraft that have fallen into new hands. This time: a Gloster Gladiator that may have served with three separate air arms

FOLLOWING EVALUATION of the Gloster Gladiator by the Latvian Aviation Regiment in 1937, an initial contract for 13 machines was signed that May. The contract specified open cockpits but was changed to include enclosed canopies. By September 1937 a further 13 machines and 17 additional Bristol Mercury engines had been ordered. The Gladiators were assembled at Riga-Spilve, the first batch being numbered 114 to 126, the second 163 to 175.

On June 16, 1940, the morning of the Soviet invasion of Latvia, the Gladiators were dispersed around the country but saw no combat with Russian aircraft. Within weeks most had been crated and shipped to Germany or Russia. On August 17, 1940, the last three Latvian-marked Gladiators flew as part of a Soviet-Latvian "Aviation Festival" at Riga-Spilve.

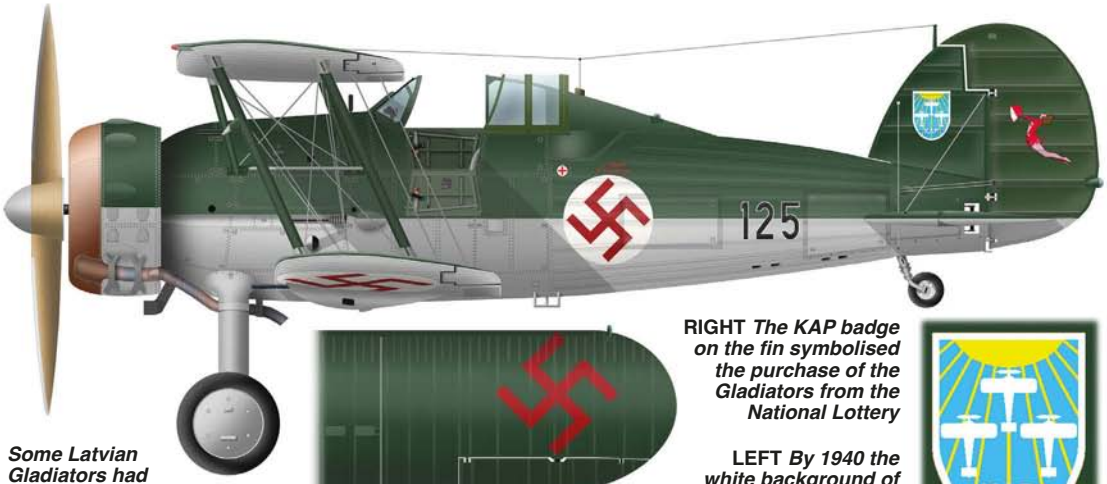
No record of the Soviet use of the Gladiators survives other than photographs showing several damaged examples with red stars on their wings and fuselages. These may date from the early stages of Germany's *Barbarossa* operation in 1941.

A document in the USA's National Archives lists war materiel captured by the Luftwaffe up to September 1, 1941, which includes 13 Gladiators. In 1980 former Luftwaffe pilot Anton Totzauer recalled the dismantled "Glosters" arriving at Langendiebach, near Hanau, by rail in 1942. He stated that they wore Soviet stars but once these were removed Finnish swastikas became evident.

The Gladiators were then employed by *Ergänszungsgruppe (S) 1* at Langendiebach for glider-towing duties during 1942–43. Several were destroyed or damaged in service and the survivors were all authorised for deletion from the Luftwaffe inventory on March 16, 1943.

G.D. ZULIS / WWW.LATVIANAVIATION.COM x 2

ABOVE ***Few photographs of the Latvian Gladiators in Soviet markings exist; this one shows them looking somewhat the worse for wear, the various insignia on the fin and rudder having been removed as souvenirs.***

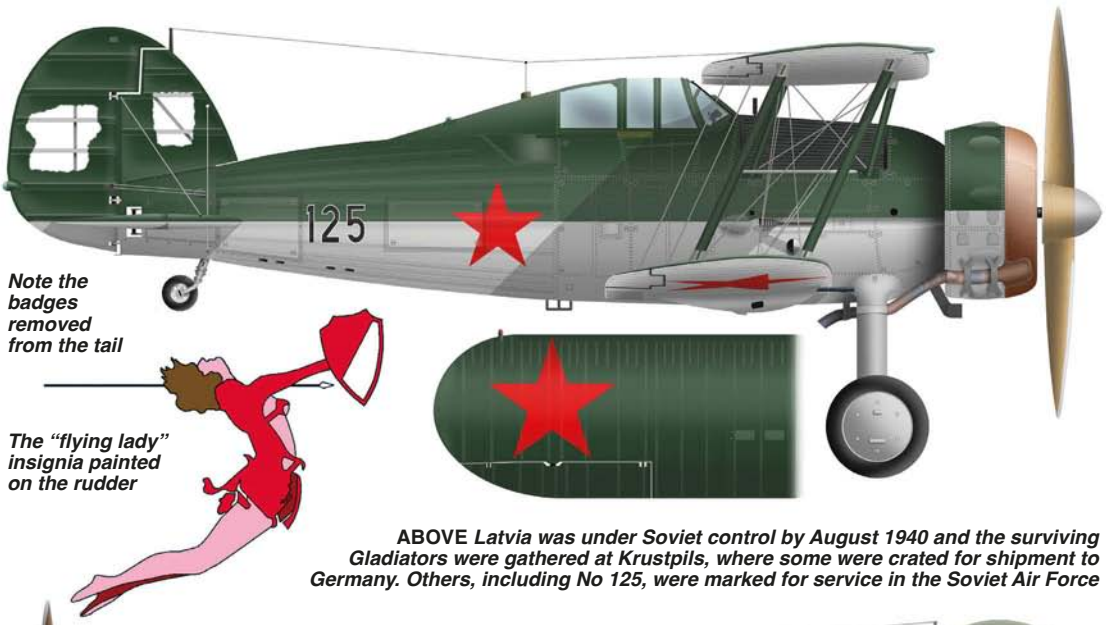


Some Latvian Gladiators had grey-painted propellers

RIGHT *The KAP badge on the fin symbolised the purchase of the Gladiators from the National Lottery*

LEFT *By 1940 the white background of the Latvian swastika on the wings had been painted out*

ABOVE *Gloster Gladiator I No 125 of the 1st Squadron, Latvian Air Force, was dispersed to Rumbull from Riga-Spilve on the morning of the Soviet invasion of Latvia on June 16, 1940*



Note the badges removed from the tail

The "flying lady" insignia painted on the rudder

ABOVE *Latvia was under Soviet control by August 1940 and the surviving Gladiators were gathered at Krustpils, where some were crated for shipment to Germany. Others, including No 125, were marked for service in the Soviet Air Force*

Records reveal that a number of Soviet Gladiators were captured by German forces, possibly including No 125, and used by the Luftwaffe to tow gliders for pilot training until all were withdrawn from use by March 1943

arvo@arvoart.com

Fly America!

HOW AMERICA'S LOCAL AIRLINES PUT MAIN STREET ON THE MAP

"Ready to board!" — Douglas DC-3s of three of the USA's local service airlines (Central, Ozark and Frontier) await their passengers at Kansas City's Municipal Airport circa 1959. The Local Service Carriers (LSCs) transported passengers from big city terminals like Kansas City, served by major airlines, to smaller cities within their individual areas of operation, in many cases offering a level of service which has been unmatched since.

ALLAN VAN WICKLER VIA JON PROCTOR

STRENGTHENED BY the award of permanent operating certificates bestowed upon them by President Dwight D. Eisenhower in 1955, the 13 Local Service Carriers (LSCs), each of them operating dependable Douglas DC-3s, settled down to the business they had been created for: bringing scheduled air transport to America's smaller cities. All 13 received government subsidies to provide much of this service and the objective was to build up enough business eventually to reduce and then eliminate these stipends. But the very nature of the short-segment operations to places that generated only hand-

Concluding his in-depth two-part history of America's post-war local service airlines, **DAVID H. STRINGER** charts the evolution of the specialised local carriers tasked with getting America on the move after the war. He takes up the story from the permanent certification of the original 13 Local Service Carriers in 1955 through to the introduction of the jet age and finally deregulation, the final nail in the coffin

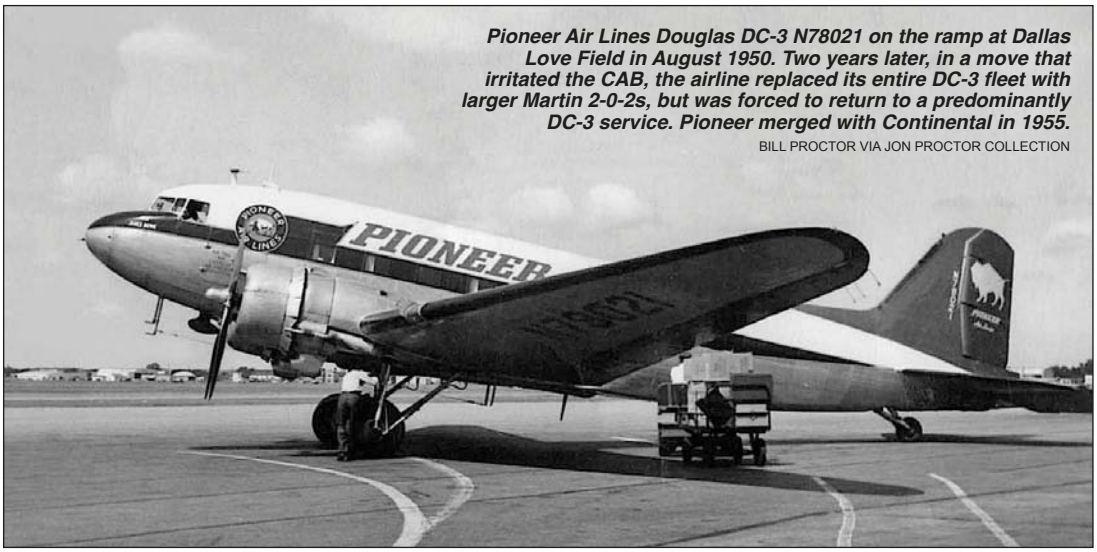
1955–78: CONSOLIDATION TO COLLAPSE

RIGHT *During the 1950s America's 13 Local Service Carriers were often promoted as a group, either by airline trade organisations or by the trunk airlines, which had come to rely on the Locals for their feeder traffic. This brochure was issued by the Conference of Local Airlines in 1956.*
AUTHOR'S COLLECTION

fuls of passengers made local air service a costly venture. Like it or not, subsidisation was here to stay.

PIONEER'S MISFORTUNES

For the carriers themselves, subsidy payments were a welcome guarantee of income; but none of the Locals was going to prosper unless they were bestowed with some revenue-generating routes. The way to do that was for the authorities to give these carriers a few profitable runs to offset their money-losing hops, but it was specifically stated by the Civil Aeronautics Board (CAB) that the LSCs were not to compete with, nor drain traffic from, the trunk-route operators. The two different types of carrier were there to complement each other — the Locals were to feed passengers to the Trunks, and vice-versa. This philosophy locked the LSCs into a business model which severely limited their ability to grow. Once a carrier's operating territory was saturated with service, that was it. Like a railway that could not grow without laying more tracks, the Locals would be expected to serve the cities in their specific area with no prospect of getting any bigger except through a merger. A local carrier could not expect eventually to shed its small cities and join the ranks of the Trunks.



Pioneer Air Lines Douglas DC-3 N78021 on the ramp at Dallas Love Field in August 1950. Two years later, in a move that irritated the CAB, the airline replaced its entire DC-3 fleet with larger Martin 2-0-2s, but was forced to return to a predominantly DC-3 service. Pioneer merged with Continental in 1955.

BILL PROCTOR VIA JON PROCTOR COLLECTION

The CAB dealt with its first major Local versus Trunk headache just a few months before Eisenhower's bill-signing. In large part, the Board had itself to blame for the problem. Pioneer Air Lines, formerly Essair, had been bestowed with the first feeder certificate issued by the Board back in 1945 (as described in *How America's Local Airlines Put Main Street On The Map*, in Issue No 3 of *TAH)*. Pioneer grew and did well in its territory, which encompassed parts of Texas and New Mexico, but still relied heavily on subsidy. Pioneer operated with good load factors over much of its system and the company bought 36-passenger post-war Martin 2-0-2s to upgrade its fleet. However, instead of adding just a few 2-0-2s to serve alongside its DC-3s, Pioneer replaced its entire fleet with the more modern aircraft, selling its DC-3s. The CAB was not happy. Here was an airline taking it upon itself to modernise when it was still dependent on government payments to survive. The CAB refused to subsidise the purchase of new aircraft when the airline had given up an entire fleet of aircraft that had been fully depreciated "at public expense".

Pioneer was forced to go back to a DC-3 operation and scrambled to find spare Gooney Birds, leasing ten of them. The Board flatly refused to underwrite the leases, claiming that Pioneer would not have incurred the lease expense had it not sold off its own DC-3s in the first place. Pioneer was in a jam. The way out was marriage with a healthier company. But the beau that came calling was not a feeder. It was Continental Air Lines, a trunk carrier. In a vote of three-to-two, the Board approved the merger, with the two dissenting members claiming that the Board was "breaking faith with all of the trunk carriers who have relied upon the many assurances of the Board that the trunks and feeders would be kept separate". An unwelcome precedent was being set whereby "a trunk could gain access to a previously inaccessible market

Frontier and Central DC-3s at Kansas City in June 1962. Note that both aircraft are converted C-47s, with the large cargo door adjoining the squared-off boarding door. Frontier absorbed Central through merger in 1967.

BOB WOODLING VIA JON PROCTOR COLLECTION

ABOVE ***In 1958 Trans-Texas Airways modified its fleet of DC-3s to its HiPer (high-performance) standard, incorporating mainwheel-well doors, streamlined oil cooler fairings and modified engine cowlings, increasing the type's cruising speed by some 26 m.p.h. The upgraded aircraft were given the soubriquet "Super Starliners".***

JON PROCTOR COLLECTION

simply by buying up a feeder". The merger became effective on April 1, 1955. Had Pioneer held out just a while longer, it too would have been blessed with a permanent certificate as the 14th LSC. The Board was happy to put the whole affair behind it and would not go down that road again. The next local carrier merger would not take place for another 12 years, and then it would be between two Locals.

THE ROAD TO DISASTER?

Just one year after President Eisenhower had validated the local service airlines, giving them "permanence" in America's great transportation system, he signed another piece of legislation that would wind up driving a nail into the coffin of the local airline network. On June 29 Eisenhower signed into law the Federal Aid Highway Act of 1956, paving the way for 41,000 miles of "superhighway", to be built over the course of the next 13 years. Officially called the National System of Interstate and Defense Highways, the framework was laid and the funding was authorised for what would become America's Interstate Highway System. The goal was to create a "safe and efficient highway network" that would "be essential to America's military and civil defense". These were the days of the Cold War and Eisenhower declared that the new road network would provide for "the personal safety, the general prosperity [and] the national security of the American people".

The Interstates would be there to assist in the evacuation of cities in case of war, just as the local airlines were supposed to help by transporting soldiers and staff among the hundreds of military installations around the nation. The Interstates would also make the drive to a neighbouring city more appealing because it could be accomplished at relatively high speed on one's own schedule.

The 13 Local Service Carriers

IN 1955 the CAB granted permanent certificates for the following 13 Local Service Carriers (LSCs):

Allegheny Airlines (formerly All American Airways)
Bonanza Air Lines
Central Airlines
Frontier Airlines (formerly Arizona Airways, Challenger Airlines and Monarch Air Lines)
Lake Central Airlines (formerly Turner Airlines)
Mohawk Airlines (formerly Robinson Airlines)
North Central Airlines (formerly Wisconsin Central Airlines)
Ozark Airlines
Piedmont Airlines
Southern Airways
Southwest Airways (later Pacific Air Lines)
Trans-Texas Airways
West Coast Airlines

But the Interstates would take years to build and, in the meantime, the Locals blossomed and grew. They had the same legitimacy as their trunk line brethren and marketed themselves with pride. Allegheny was the "Airline of the Executives", while Ozark was "The Business Man's Airline". Bonanza was the "Route of the Gold Strikes"; Mohawk, "Route of the Air Chiefs"; Piedmont's was the "Route of the Pacemakers". America was on the move and the local service airlines were making it possible.

THE RIGHT AIRCRAFT FOR THE JOB

All 13 carriers flew DC-3s with varying capacity. The original DC-3 layout called for 21 passengers in seven rows of seats with two on one side of the aisle, one on the other. But many airlines went to a two-plus-two configuration, and there were

JON PROCTOR COLLECTION x 2

LEFT ***Southern Airways' first group of female flight attendants in 1951. The image of a glamorous stewardess in the cabin resonated with most local airline managements and the change brought them into step with trunk carriers. Southern would not hire male attendants again until the 1970s.***

RIGHT ***Mohawk Airlines bested its local service compatriots in the equipment race by being the first of the LSCs to introduce pressurised aircraft in the form of Convair 240s. Here N1014C, acquired from Swissair in 1956, is prepared for another flight.***

BELOW ***Lake Central Airlines DC-3 N14967, with a company Convair 340 in the background, in December 1963. Lake Central struggled through the 1950s, but was rewarded with a huge route expansion in 1961, after which it acquired Convairliners.***

differences among the Locals in the range of seating. In 1955, Bonanza, Mohawk and Southwest had 28 seats aboard their DC-3s; Ozark and Allegheny, 27. Southern, Piedmont and West Coast had accommodation for 24 passengers aboard their DC-3s, while Central's carried 22.

All of the DC-3s flown by the Locals were hand-me-downs, enjoying a second chance at service after having flown for trunk airlines, corporations or the military for years. From the start there were pundits who claimed that the Douglas transport was totally inappropriate for local service routes. It was too big for some markets, too small for others. Seat-per-mile costs were too high. The call for a "DC-3 replacement" went out to aircraft companies worldwide but there were differences in opinion as to the specifications for such a machine. Besides, most aircraft manufacturers were preoccupied with creating new turboprop and turbojet designs for the major carriers.

In reality the DC-3 was the right aircraft in the right place at the right time, available in quantity for the new LSCs. In 1956 many of the trunk airlines, including Braniff, Capital, Delta, Northwest and Western, still had DC-3s in their fleets, so travellers transferring from Local to Trunk or vice-versa could find themselves enjoying the same level of experience aboard both. And not to be overlooked, the size of the DC-3 required the inclusion of a flight attendant in its crew, giving an aura of big airline sophistication to the aircraft landing in Kokomo, Paso Robles or Stillwater.

Not that there was much in the way of food or beverages to serve. But the stewards and stewardesses were there for the comfort and safety of their passengers, representing the company that was taking the resident of Main Street, USA, into the lofty heavens, just like their big-city counterparts. Many of the Locals started out with male attendants in the cabin as the

JON PROCTOR COLLECTION

original plan of some feeders was to have the cabin crew member, sometimes called a flight agent, assist with loading and unloading baggage at intermediate stops, even selling tickets in flight. Most managements quickly realised, however, that these tasks were well-covered by ground employees, and switched to hiring women in order to present the public with their own version of the glamorous stewardess (or air hostess) wearing the company's uniform.

UPDATING THE FLEET

Having learned from the cautionary tale of Pioneer's mistake, the next Local to add bigger aircraft was Southwest Airways, which would eventually change its name to Pacific Air Lines. Southwest acquired four Martin 2-0-2s in 1953, but only to add capacity on its stronger routes. The company wisely retained its DC-3s.

Next up was Allegheny Airlines, which followed the same path, adding Martin 2-0-2s to supplement its DC-3 fleet in the summer of 1955. Allegheny referred to its new aircraft as Martin Executives. The final purchase of larger equipment during the mid-1950s was made by Mohawk Airlines, which added a few Convair 240s to its fleet in 1955. Mohawk's purchase outshone those of Allegheny and Southwest because its Convairs were the first pressurised aircraft to be employed by an LSC. The Martin 2-0-2s lacked a cabin pressurisation system.

The Locals got a boost in 1957 when Congress passed a bill promising government loan guarantees for the purchase of new aircraft to help the carriers replace their reliable but ageing Gooney Birds. The most promising of the DC-3 replacement designs offered was Fokker's F.27 Friendship, built under licence in the USA as the Fairchild F-27. A high-winged pressurised turboprop-powered aircraft, the F-27 carried 36–40 passengers. West Coast Airlines became the first carrier anywhere in the world to operate the type when it introduced the Fairchild-built F-27 into service on September 28, 1958. West Coast was followed quickly by Piedmont. Pacific, Bonanza and Ozark quickly followed suit with their first F-27s the following year.

Since its seating capacity was greater than that of the DC-3, the F-27 was not technically a substitute for that aircraft. Nevertheless, one of the Locals, Bonanza, had replaced its entire fleet of DC-3s with F-27s by November 1960. The company then started advertising itself as the "first all jet-powered airline in America", perhaps a bit of a stretch, but a catchy slogan all the same.

Not to be outdone in the quest for larger equipment, both North Central and Frontier introduced 44-passenger Convair 340s, purchased secondhand from United Air Lines, in 1959. Thus, by the end of the decade, all but four of the Locals had supplemented their DC-3 fleets with larger aircraft. It would not be until 1961 that the remaining holdouts would acquire bigger aircraft.

Trans-Texas Airways (TTA) and Central both added secondhand Convair 240s purchased from American Airlines, while Lake Central bought Convair 340s from United. The last of the Locals to introduce larger equipment was Southern Airways, which bought a number of Martin 4-0-4s from Eastern Air Lines, and dubbed them "Southern Aristocrats".

Rudyard Kipling wrote that "transportation is

ABOVE ***Southern Airways was the only one of the 13 Locals to make the change from piston-engined aircraft to jets without employing turboprops in between. The airline flew Martin 4-0-4s, as seen here, until the last day of their authorisation for use by a certificated carrier in April 1978.*** **LEFT** ***Frank Hulse, Southern's founder and president.***

JON PROCTOR COLLECTION x 2

civilisation", and nowhere was that maxim more apposite than in the USA. In less than a century, sailing ships, steamboats, stagecoaches and most importantly, railways, had pushed civilisation westward across a continent, bringing settlers and modern conveniences to all parts of the contiguous United States. Airlines were the next important step in bringing Americans closer together, and it would be the local airlines that would strengthen the bonds of commerce and communication for everyone.

USE IT OR LOSE IT

By the mid-1950s rail passenger service had already begun its slow decline in the USA as the individual railways vied for passengers against a vast network of bus lines and the well-regulated airline network. Freight was much more profitable for railways than passenger service, with its required amenities. So the LSCs were developing at just the right time to take traffic from the railways and before the completion of the Inter-state Highway System.

In 1958 the CAB made a number of rulings with historic significance. In the Seven States Area Case, the Board not only transferred 24 smaller stations from trunk lines to locals in the upper Midwest and on the Great Plains, it also put many small isolated communities on to the Frontier Airlines map. When the CAB was fashioning its concept of feeder, or local, airlines back in the 1940s, one of its goals was to bring air service to remote and rural communities. In the "Lower 48" states, those places were generally on the prairies and in the mountains of "The West". The idea, in the Board's words, was to establish "a transport facility so greatly superior to that now available that the patronage will exceed that which could be developed at even larger cities not so greatly isolated". It was a grand vision for cities the size

Allegheny Martin 2-0-2A N93204 at Detroit Metropolitan Airport in July 1962. Unlike the 4-0-4, the 2-0-2 was unpressurised; craftily, Allegheny never used the 2-0-2 designation and only ever referred to the type as the "Martin Executive".

BOB PROCTOR VIA JON PROCTOR COLLECTION

***Convair 600 N74856 of Central Airlines at Dallas Love Field in July 1966, painted in the stylish two-shades-of-grey-over-white colour scheme introduced by the airline the previous year, along with a new symbol, the "Aerograph", which was applied prominently on the fin and in the company's literature, as seen* BELOW.**

TIMETABLE: AUTHOR'S COLLECTION

of Lusk, Wyoming (1960 population: 1,890), Lemmon, South Dakota (2,412), and Ainsworth, Nebraska (1,982), all of which became part of Frontier's system as a result of the Seven States Case. Because of the geography of The West, a city with 2,000 residents may be as important as a community ten times its size "back East". To quote Frontier's own public relations material: "Communities once isolated by mountains or other geographical barriers, by inadequate surface transport or by sheer remoteness have now been brought within minutes of each other and their major trading centres".

But the subsidy issue was always front-and-centre. Congressmen and senators all wanted air service for the smaller cities in their own states but, when it came to talk of fiscal responsibility, those same politicians insisted that the amount of subsidy payments had to be reduced. While every city was grateful to have scheduled air service, some could not generate enough passengers in a month to cover the costs of keeping the airport station open. The very nature of local airline operations, comprised of many take-offs and landings with short hauls of usually less than 100 miles, was not a recipe for profit-making. Airliners make money when they spend more time at cruise altitude. Burning fuel on repeated climb-outs from airport runways spends much of the revenue taken in from the few boarding passengers at the small cities and towns being served.

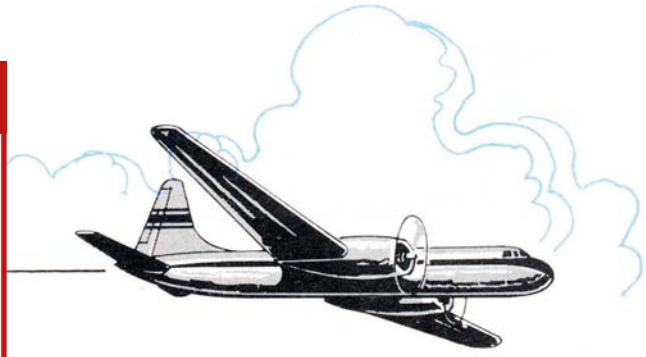
In Frontier's case, the company had a new owner and president making himself at home in the company's Denver headquarters just about the time that the CAB was gifting the company these smaller cities. Some 17 airports in Nebraska alone were joining Frontier's system. The company's new master, Lewis B. "Bud" Maytag Jr, heir to a washing-machine fortune, wanted an airline that he could build up profitably by flying people between major cities aboard the big new turbojets soon to be introduced. Under the new arrangement he was stuck with having to fly people in and out of Newcastle, Wyoming, and Valentine, Nebraska, requiring thousands of dollars in subsidy annually just to break even. He could see no profit in offering services to cities that could not generate enough traffic to pay for themselves.

The CAB recognised that providing air services to smaller communities was a two-way street. An airline would be required to serve Main Street, USA, but Main Street also had an obligation to use the service being provided. As part of the Seven States ruling, the CAB officially instigated a "use it or lose it" policy, whereby a city was required to board an average of five passengers per day (1,825 per year) or risk losing its air service. A community would have six months from the inauguration of a service to get its

The vital link: a decade of growth

THE DECADE FROM 1953, when the fledgling Local Service Carriers (LSCs) were still referred to as Feeder Airlines, to 1963, some eight years after the final 13 local airlines had been certificated, was the high point of the USA's local airline service. The figures published by the Air Transport Association of America in 1964 show the rapid growth of the local airline network.

	1953	1963
Cities authorised to be served	350	475
Cities served exclusively by LSCs	195	300
Aircraft in service	219	383
Jets in service or on order	0	65
Employees	6,000	15,525
Passengers	2,032,000	8,867,000
Passenger miles	391,384,000	1,869,000,000
Ton-miles of mail	1,000,000	4,353,000
Ton-miles of freight	1,179,000	9,026,000



"Were the Local Service Carriers expected to grow and produce expanding profits or were they public utilities expected to perform a service whether it was profitable or not . . .?"

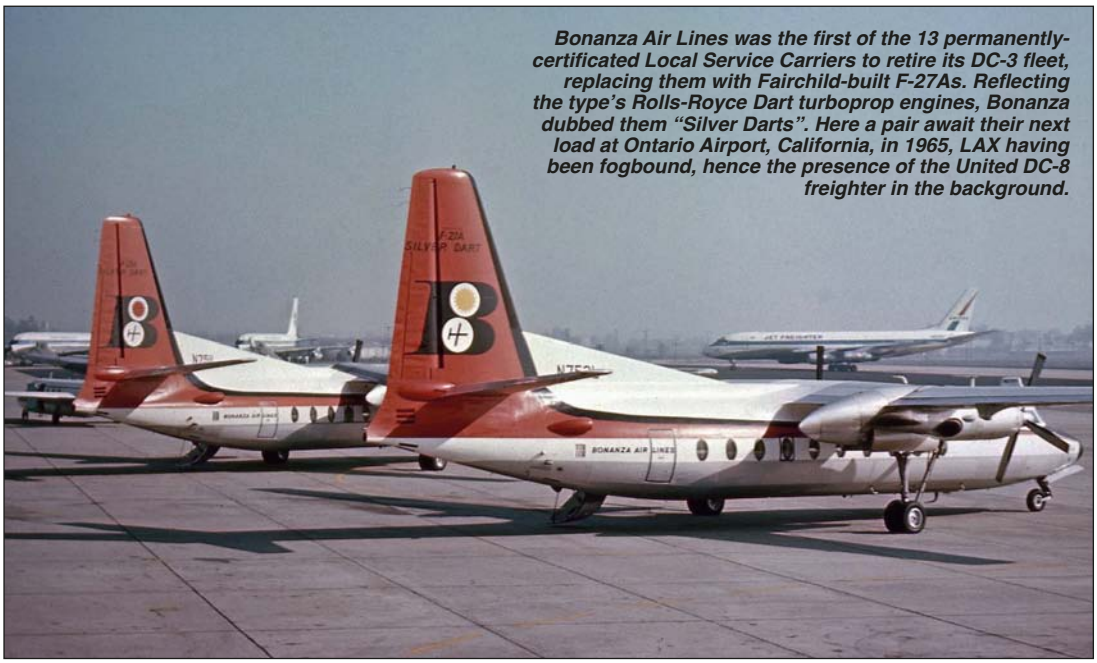
citizens familiar with it, then for the following 12 months the municipality would be expected to produce the five-passengers-per-day requirement, "in the absence of unusual or compelling circumstances" (a term open to interpretation).

It was suspected by some that Maytag at Frontier had found a way to rid his company of the obligation to serve minimally-productive stations. He was accused of "sabotaging" services, particularly on a route called Segment 13, which hopped its way across northern Nebraska. The Nebraska Department of Aeronautics claimed that Frontier provided "a quality of service falling far below minimum standards", so much so that "public confidence has been destroyed". The state went on to say that "the difficulty is caused by a change in Frontier's management, since the new management appears to have no concept of a public utility's dedication to public service, but rather believes that all unprofitable segments should be abandoned". Unknowingly, the State of Nebraska had identified the basic dichotomy facing the Locals in a capitalist economy: were they companies expected to grow and produce expanding profits or were they public utilities expected to perform a service whether it was profitable or not? America's local service airlines were supposed to be both.

Bud Maytag left Frontier and bought a trunk carrier, National Airlines, after only four years at the helm of the local airline, but not before he had relieved Frontier's route map of many of the isolated stations bestowed upon it by the Seven States Case. Frontier's new president, Lewis W. Dymond (**INSET OPPOSITE**), immediately set about mending fences with Nebraska, salvaging the airline's service still in effect in that state. But Maytag had, willingly or not, taught a lesson to the other local service

Frontier Airlines was one of several Locals to upgrade its piston-engined Convairs to 580 configuration by replacing the 340's Pratt & Whitney R-2800s with Allison 501D turboprops and incorporating an enlarged fin and a modified tailplane. This 580, N73127, was photographed at Colorado Springs in October 1968.

GRAHAM SKILLEN



JON PROCTOR COLLECTION

Bonanza Air Lines was the first of the 13 permanently-certificated Local Service Carriers to retire its DC-3 fleet, replacing them with Fairchild-built F-27As. Reflecting the type's Rolls-Royce Dart turboprop engines, Bonanza dubbed them "Silver Darts". Here a pair await their next load at Ontario Airport, California, in 1965, LAX having been fogbound, hence the presence of the United DC-8 freighter in the background.

managements: if you don't want to be burdened with an unproductive station, make the service so inconvenient that the public simply won't want to use it.

GROWING PAINS

The Locals had to be given some lucrative routes which would help generate enough income to lessen their reliance on subsidies. Bonanza Air Lines, which was strapped with a weak network, was given authority to fly non-stop between Las Vegas and Phoenix, Las Vegas and Reno and then between Phoenix and Salt Lake City, a 3hr 20min flight, at the time the longest scheduled non-stop DC-3 service in the continental USA. Although these were trunk carrier-type non-stops between big cities, there was no competition on any of the three segments.

In 1957 the CAB set a precedent by awarding Mohawk Airlines non-stop authority between Syracuse, New York, and New York City, in direct competition with American Airlines, a trunk carrier which had been serving the route for years. However, Mohawk's local service system was centred on New York State and the Board felt that there was room for both carriers on the segment. Both airlines deployed Convair 240s on the 198-mile (320km) route and although Mohawk could not offer the frequency of American's flights, it operated a "turnaround" service, in contrast to American's flights, which continued on to Rochester and points-west. Mohawk advertised that every seat on its non-stop flights between the two cities was available to passengers in that market. The authority was a financial boon to Mohawk.

Two years later, in 1959, Allegheny Airlines was given permission to operate non-stop between Pittsburgh and Philadelphia, in direct competition with TWA and, to a lesser extent, United and Capital. Allegheny introduced an innovative commuter service that included such novelties as offering booklets of commuter tickets at a reduced rate, walk-up no-reservation service and the ability to pay one's fare on board. The service quickly became popular.

Out west, still trying to shore up Bonanza's finances in 1962, the CAB allowed Bonanza to fly non-stop on the lucrative route between Los Angeles and Las Vegas in direct competition with Western Airlines' four-turboprop Lockheed Electras. Both TWA and United also served the route but Las Vegas was simply an intermediate point for those two carriers which were more interested in capturing the long-haul traffic between Las Vegas and the Midwest and East. By this time Bonanza was operating 38-passenger F-27s and the little airline quickly captured 30 per cent of the market by introducing a round-trip excursion fare.

Each of the Locals added more cities while dropping unproductive stations as they grew. In a regulated industry each addition and deletion had to be approved and frequently the requests were denied. Local airlines served 516 American cities in 1958. Of those, 283 were served exclusively by the Locals. By 1966 those totals had reached 588 and 418 respectively. In 1958 the

When Bonanza joined the pure-jet-set with its acquisition of Douglas DC-9-14s during 1965–66, it christened them "Funjets" and immediately put them to work on it most poular routes, including the much-travelled Los Angeles—Las Vegas segment. Bonanza's first DC-9, N945L, was delivered on December 19, 1965, and is seen here in May 1968, shortly before becoming part of the merged Air West fleet. JON PROCTOR COLLECTION

13 Locals employed a total of 242 aircraft, the vast majority of them DC-3s. By 1966 there were 410 aircraft in the Locals' fleets, 160 of which were turbojets and turboprops. The remaining 250 were piston-engined Convair and Martin twins and a rapidly dwindling number of DC-3s. Allegheny, Bonanza, Mohawk, Pacific and Piedmont had already disposed of their weary Gooney Birds.

THE JET AGE

As each of the Local Service Carriers was adding larger aircraft, all in the 36–50-passenger range, America's trunk airlines were adding examples of the first generation of turbojet-powered aircraft to their fleets. Lake Central's DC-3s and TTA's Convair 240s would now be exchanging more and more passengers with Boeing 707s and Douglas DC-8s. Local airline managers knew that it would not be long before their passengers expected the same level of aircraft experience, especially on high-volume routes.

Pure-jet-powered aircraft would be needed on competitive services like Bonanza's Los Angeles—Las Vegas and Mohawk's Syracuse—New York City routes. Both airlines wanted to purchase the British Aircraft Corporation One-Eleven twinjet but the CAB baulked. Here were government-subsidised carriers wanting to use government-backed loans to purchase foreign-built jets. Bonanza's Edmund Converse (**INSET ABOVE**) was "redirected" to the American aircraft manufacturers and eventually ordered three Douglas DC-9s in 1963 for delivery in 1966. Mohawk was in better shape and ordered four One-Elevens, becoming the first LSC to operate a turbojet aircraft, in 1965.

Once Bonanza and Mohawk had ordered jets, every Local had to have them. Allegheny, North Central, Ozark, Southern, Trans-Texas and West Coast all queued up for the DC-9, while Frontier, Pacific and Piedmont eventually acquired Boeing 727s. Central and Lake Central, traditionally two of the weakest Locals, eventually saw the writing on the wall. Central signed a lease for two DC-9s and Lake Central opted to wait for Boeing's new 737. Both airlines would disappear before receiving their jets.

In the meantime, the French had produced an aircraft which was finally supposed to be the perfect DC-3 replacement. Accommodating 27 passengers, similar in capacity to the DC-3, the Nord 262 was a high-wing twin-engined turboprop that promised lower seat-mile operating costs than the ageing Gooney Bird and had the appeal of a modern transport. Lake Central Airlines was sold on the new aircraft and staked its fortunes on it. The company signed up to become the distributor for Nord in the USA, and introduced the turboprop to its own network on October 31, 1965 — Halloween — a fitting date for the nightmare that was to follow.

At first the 262s began incurring maintenance delays — so far, so normal — not unusual with the introduction of a new type. But the aircraft's Turbomeca Bastan engines also started suffering catastrophic failures in flight. No fewer than four of these incidents occurred, the last two less than a week apart in August 1966, one near Morgantown, the other near Martinsburg, both in West Virginia. Two passengers were seriously injured in the Morgantown incident but, fortunately, nobody was killed in any of the occurrences. The Nord fleet was grounded until the design engineers found the source of the problem; corrosion caused by the water methanol injection system. Repairs were made and the type was returned to service with Lake Central,

Once again Mohawk got the upper hand in the equipment game when it became the first of the Locals to introduce turbojets into service. The airline's first BAC One-Eleven, N2111J (c/n 029), entered service on July 15, 1965.

TAH ARCHIVE

rechristened the Nord II, in February 1967. But the damage to the French machine's reputation had been done and it never caught on as a proper DC-3 replacement in the USA.

FROM LOCAL TO REGIONAL

With the introduction of jets, a number of the Locals started calling themselves Regionals. Now that they had those jets, they had to fill them with passengers flying long enough stages to make money. The CAB devised a clever strategy to try to minimise infringement on the trunk carriers. Local airlines were awarded routes connecting groups of smaller cities with large metropolitan areas outside of their normal sphere of operation. The new jets would land at several small stations collecting passengers, then avoid the typical connecting hub and carry those passengers non-stop to the big city themselves. Southern Airways, Ozark Air Lines, North Central and Piedmont were all given entry into New York. Trans-Texas Airways changed its name to Texas International in 1969, and soon its jets were flying as far west as Los Angeles. The DC-9s and 727s of the Locals were in line for take-off alongside similar jets from the Trunks.

At the other end of the spectrum, Allegheny, historically one of the most successful LSCs, entered into an agreement with Henson Aviation of Hagerstown, Maryland, in 1967. Operating as The Hagerstown Commuter, Henson, a third-level airline, had been operating small aircraft between Hagerstown and Washington DC National (now Ronald Reagan Washington National Airport). With the CAB's approval Henson would substitute its own flights for Allegheny's at Hagerstown, operating into Baltimore Friendship (now Baltimore-Washington International Airport). Reservations and support services were handled by the larger carrier. To be known as "Allegheny Commuter" instead of Henson or Hagerstown Commuter, this was the first attempt at what would become known as code-sharing. It was successful and Allegheny

Lake Central saw the Nord 262 as its ticket to a bright future, but it was not to be; within weeks of this photograph of N26201 being taken at Washington National Airport in July 1966, Lake Central's entire 262 fleet was grounded for investigations into a series of engine failures.

BOB PROCTOR VIA JON PROCTOR COLLECTION

Riley Heron N14FB (c/n 14078) was used by Galion, Ohio-based GCS Air Service, an early Allegheny Commuter subcontractor, to replace Allegheny's regular service between Cleveland and Mansfield, Ohio. Note the modified Heron's Lycoming IO-540 flat-six piston engines.

TAH ARCHIVE

started to replace its service at other small stations with independent third-level operators working under the Allegheny Commuter banner.

While Allegheny had always done well serving the heavily populated and industrialised north-east, among the weakest Locals was Central Airlines, tasked with serving small cities in Oklahoma, northern Texas, Arkansas, Missouri and eastern Colorado and on the plains of Kansas. Central served every city in Kansas and Oklahoma that had scheduled service. Central had undertaken merger talks with neighbouring Ozark Air Lines at least twice during the early 1960s. Finally the company agreed to merge with the local carrier to its west and north, Frontier Airlines. Central had recently undergone a major image makeover and had announced a lease agreement for two DC-9s. Neither would fly in Central's colours, however. Central became the first of the 13 permanently-certificated Locals to lose its identity when it became part of Frontier in October 1967. And then there were 12.

Meanwhile, Lake Central, which was trying to recover from its fiasco with the Nord 262, suffered its first fatal accident when a Convair 580 crashed in western Ohio on the evening of March 5, 1967. All 38 aboard perished. The cause of the crash was determined to be the fault of the engine manufacturer, owing to an improperly-machined part. The starboard propeller assembly had failed, sending a prop-blade slicing through the aircraft's cabin. The airline itself was not at fault but, once again, it was a blow to public perception. Soon thereafter, Lake Central accepted a merger offer from Allegheny and, as of July 1, 1968, one more of the original 13 was gone.

Also in 1968, the three Locals operating in the far west — Pacific Air Lines, Bonanza Air Lines and West Coast Airlines — reached a merger agreement and came together in a three-way marriage to form Air West. The company would become Hughes Airwest two years later when it was purchased by eccentric investor Howard Hughes. Now there were nine.

THE BEGINNING OF THE END

The Interstate Highway System was growing year-by-year. After the 1956 opening of Interstate 90, part of which spans the 60 miles between Rockford, Illinois, and Chicago's O'Hare Airport, the number of passengers carried by Ozark Air Lines from Rockford plummeted from more than 29,000 in 1957 to fewer than 12,000 in 1961. It was a story that was repeating itself in less dramatic

Having studied the various short-haul jets on offer, North Central Airlines held out for the initial stretched version of the DC-9, the Series 30, which could carry 100 passengers comfortably in a single-class configuration. Under the long-term stewardship of Hal N. Carr, North Central became one of the strongest Locals.

TAH ARCHIVE

In 1968 three LSCs (Bonanza, Pacific and West Coast Airlines) merged to form Air West. Howard Hughes acquired the outfit and changed its name to Hughes Airwest in 1970. Photographed at LAX in October 1978, DC-9-30 N9347 is painted in the company's distinctive "Top Banana in the West" colour scheme.

K.P. LAWRENCE VIA TAH ARCHIVE

figures elsewhere in the country. It was becoming easier and less expensive to use the family car for trips of less than 100 miles.

After suffering several years of financial setbacks and, finally, a pilots' strike, another of the Locals, Mohawk Airlines, succumbed to merger in 1972. It, too, was swallowed by Allegheny, which spread its wings from Boston and Montreal to Memphis and St Louis. The Locals were now truly Regionals, still controlled in growth by the CAB, but operating increasingly in competition with the Trunks while still serving the most productive of their small stations.

There was a growing movement in the halls of Congress to deregulate the airline industry. Some felt that it had been nurtured and grown by the CAB long enough, that it was now time to do away with the Board and let the carriers sink or swim. The feeder model had also been displaced. No longer did the passenger from Dothan, Alabama, fly Southern Airways to Atlanta to connect with Delta or Eastern to take them to New York or Chicago. Now they could fly Southern all the way to the Big Apple or to the Windy City. The Regionals were now looking more like small trunk carriers. (In 1981, the term trunk would be retired in favour of majors and nationals.) In October 1978 President Jimmy Carter signed the airline deregulation bill into law and things changed quickly.

Two of the former Locals whose route networks were not complementary, Southern and North Central, merged to form Republic Airlines in July 1979, operating on the correct assumption that, in a deregulated environment, bigger was stronger and more likely to survive. Republic acquired Hughes Airwest the following year and, in 1986, the big airline, which had originally been five different Locals, was itself acquired by Northwest Airlines.

Ozark quickly expanded to Florida, Texas and California, carrying passengers coast-to-coast via its St Louis hub until it was absorbed by its St Louis neighbour, TWA. Texas International Airlines (formerly TTA) came under the mantle of Frank Lorenzo, who merged the airline with Continental in 1982, retaining the latter name. Frontier Airlines faced stiff competition in the deregulated environment, was purchased by People Express, eventually declared bankruptcy and ceased operations in 1986.

Finally there was Allegheny, which changed its name to USAir in 1979, then to US Airways in 1997. In 1989 it acquired another of its former local service brethren, Piedmont Airlines, which itself had grown into a transcontinental and transatlantic operation. US Airways merged with America West Airlines in 2005 and, although the latter was technically the surviving carrier, the merged company chose to retain the US Airways name.

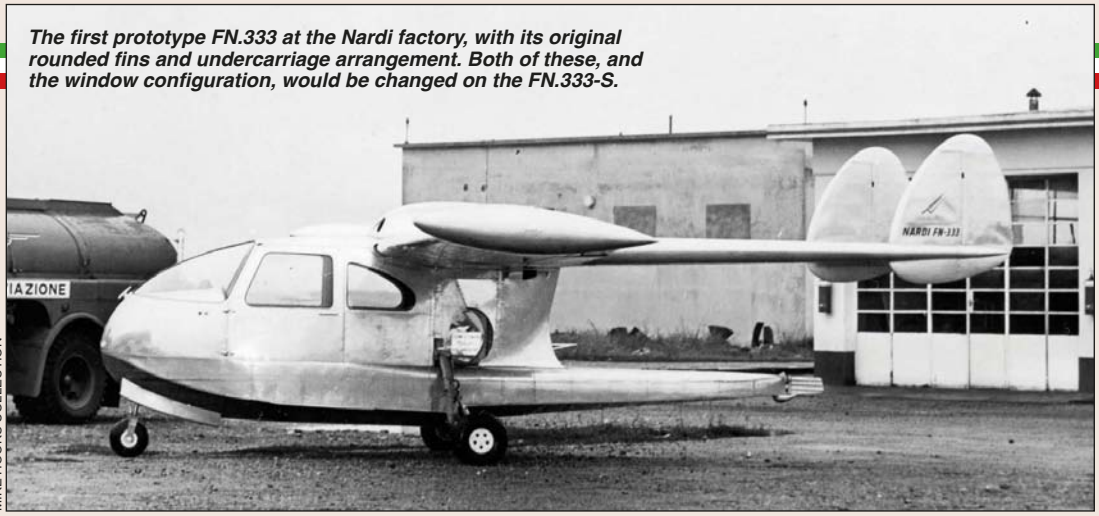
In hindsight, the Locals could not have been prevented from growing and changing, especially after the introduction of jets. The freedom granted to the American driver by the Interstate Highway System and the desire of politicians to reduce or eliminate subsidy for an essentially social programme took their toll on what was an uneconomical, yet beneficial, service. Then deregulation changed everything.

Many of America's small cities once served by the LSCs no longer receive any scheduled air service at all. Some of them still enjoy airline operations provided by contract carriers associated with today's major airlines, a direct outgrowth of Allegheny's 1967 experiment with The Hagerstown Commuter. Many of the remaining small city operations are covered under today's Department of Transportation Essential Air Service (EAS) programme. But the best pattern of air service ever enjoyed by many of America's smaller cities was that provided by the regulated and subsidised LSCs of the 1950s and 1960s; the group of 13 airlines that put Main Street USA on the map.

the Riviera touch

Closely resembling the better-known Republic Seabee, the arguably more graceful Nardi FN.333 was a fine amphibian in its own right, although it was not to enjoy the healthy sales of the Seabee. This early production example wears the Italian equivalent of B Conditions markings, the prefix I-RAI being applied by the Registro Aeronautica Italiano *(RAI) to aircraft under test.*

Seemingly swimming against the tide of Europe's ambivalence towards waterborne aircraft, Italian aircraft manufacturer Nardi nevertheless staked its post-war future on a stylish civil amphibian. ***ROD SIMPSON*** *tells the story of the elegant FN.333 Riviera*



The first prototype FN.333 at the Nardi factory, with its original rounded fins and undercarriage arrangement. Both of these, and the window configuration, would be changed on the FN.333-S.

MIKE HOOKS COLLECTION

IN THE USA and Canada seaplanes have long been a fact of life, with a number of specific amphibian designs, such as the Lake LA-4, Republic Seabee and Thurston Teal, being produced in fair quantities for sports flyers and commercial operators. To serve the remote residents of the Canadian lakes a seaplane is just about the only practical means of transport, and many of these isolated locations rely heavily on floatplanes for the rations which are taken for granted elsewhere. By contrast, Europe has been a much less fruitful territory for the builders of waterborne aircraft. A much less understanding attitude has prevailed in European governments and strict rules applied to restrict the areas of lake or river which may be used by seaplanes. In many countries, it is only legal to alight or take off from a licensed "water aerodrome" and, as a result, the number of these aircraft registered in European countries has been limited.

Predictably, European aircraft manufacturers have tended to steer clear of amphibious aircraft when they have not been able to count on a strong domestic market. There have been a few successful designs — notably the Piaggio P.136 and the Short Sealand — but even these were unable to penetrate the key North American market. One amphibian, however, the Nardi FN.333, was designed in the immediate post-war years to open up new vistas in Europe and to challenge the Americans on their own territory.

The fratelli Nardi

Italian company Nardi S.A. per Construzioni Aeronautiche was established in 1933 in Milan by Luigi, Euste and Elio Nardi. It was originally formed in order to develop the FN.305 tandem two-seat trainer and later it also built the highly successful FN.315 which was used in Italy and several other countries during the late 1930s.

In the immediate post-war years, Nardi sought a new direction for its design team and eventually settled on the concept of a light three-seat amphibian which would have applications for both civil and military operators. It seemed as if waterborne aircraft would have a bright future in the airminded era of the 1950s and Nardi was well aware that Republic had found a good market for its "Thunderbolt Amphibian" — otherwise known as the Seabee. Indeed, the FN.333 had a forward fuselage which was very similar to that of the Seabee. A graceful rounded nose and cabin area with a smoothly-swept planing hull followed the Republic design philosophy to the letter. Nardi chose to give the FN.333 a pair of entry doors in the centre of the cabin, rather than adopting the starboard nose entry door used on the Seabee, but a very similar arrangement was used for the retracting nosewheel which was let into the underside of the forward hull.

At the point where the wing joined the fuselage all similarity with the Seabee ended. The FN.333 was fitted with slender twin booms attached to the rear inboard sections of the wings and two oval fin/rudder assemblies were mounted at the end of the booms, while a constant-chord tailplane and elevator joined the two fin units.

The new amphibian was powered by a 145 h.p. Continental C-145 engine mounted as a pusher on top of the rear fuselage. The main air intake for the engine was at the front of the nacelle but small supplementary intakes were positioned in the wing roots. The two-bladed propeller rotated behind the sharply cut-down rear fuselage and the main structure was completed with a long trailing hull section which extended almost to the level of the tailplane.

The structure was designed to accommodate the main units of the retractable tricycle undercarriage in large wells positioned behind the cabin and beneath the engine nacelle. The undercarriage

RIGHT ***The mainwheels of the first prototype retracted by means of a complex sequence of movements into wells set above the hull and below the engine compartment. This was simplified in later production Rivieras, on which the mainwheels were accommodated in the hull within a blister fairing.***
PHILIP JARRETT COLLECTION

BELOW ***The prototype extends its undercarriage before coming ashore at the Linate seaplane base, close to the Nardi factory in Milan, in 1953. The prototype was fitted with a two-bladed Aeromatic air-controlled automatic variable-pitch propeller, but three-bladers were fitted to most production FN.333s.***

units themselves were complex with multiple joints; they swung outwards and down to give the aircraft a respectable degree of ground stability. The FN.333 had a float under each wingtip which was attached to thin tubular struts and which was retractable, the floats looking like wingtip fuel tanks when the aircraft was in flight. These also acted as aerodynamic endplates to stabilise the airflow over the outer section of the ailerons.

First flight

The prototype FN.333 was constructed during 1951–52 and made its first flight on December 4, 1952. Photographs of this aircraft have never shown any civil registration markings but it has been reported as being I-KISS; it may have been allotted either a military registration in the experimental test series or one of the I-RAI* registrations which are reserved as the Italian equivalent of British B Conditions markings for manufacturers' preliminary flight tests. This first aircraft was subjected to rigorous evaluation and made many take-offs and alightings before it was destroyed when it was spun involuntarily during a stall check with flaps down. Sadly the pilot was killed. However, Nardi had gained enough information to be convinced that the amphibian had sufficient promise to become a viable production machine.

Lessons learned with the three-seat FN.333 indicated to Nardi that the definitive production version should be a larger machine with an extra seat and greater range and payload than the original concept. Therefore it was decided that the dimensions would be somewhat enlarged and that a 225 h.p. Continental engine would be fitted. In this form the aircraft was to be known as the FN.333-S.

An interesting feature of the proposed FN.333-S was an unusual mechanism for folding the wings for hangar storage. The wings were to be hinged just outboard of the tailboom junction and at the inboard end of the ailerons. When the aircraft was floating on the water with the retractable floats in the extended position it would be possible to fold the wings so that the floats stayed in contact with the water and gradually reached their fully retracted position as the outer wings folded into

RIGHT ***The cockpit of one of the FN.333-S prototypes, the first of which (possibly given the temporary registration I-RAIE) made its first flight in December 1954. The view from the amphibian's cabin was excellent, both the engine and the high wing being above and behind the occupants.*** GREGORY ALEGI COLLECTION

BELOW ***The second of the FN.333-S production prototypes, I-EUST, which was built by Fiat in Turin and first flew in October 1956. Note the absence of a water rudder at the stern of the hull (this was added later) and the revised squared-off fins.***

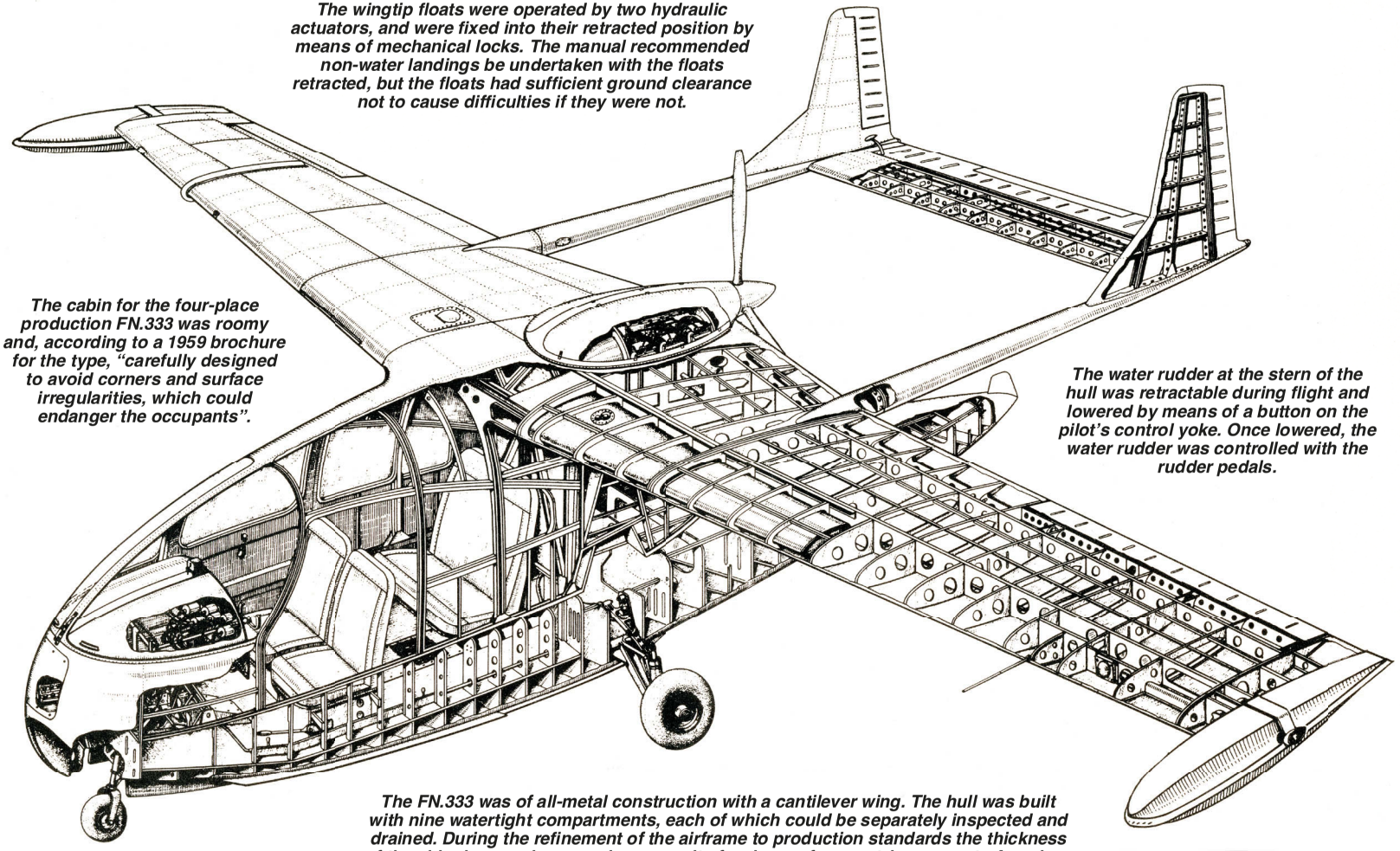
a vertical position. Nardi felt this would be valuable in stabilising the machine during the critical docking mode but, as it turned out, none of the aircraft which were subsequently built were able to take advantage of this system. The main problem was that much of the fuselage was taken up by the cabin and undercarriage bay and therefore the only way to achieve adequate fuel storage was to fit the main tanks in the wings. This meant that it was impossible safely to fit the necessary fuel lines or to avoid spillage of fuel when the wings were being folded.

Revisions and refinements

The FN.333-S prototype, which first flew on December 8, 1954, was clearly a more substantial machine and was powered by a 250 h.p. Continental IO-470 engine. Again, this prototype does not appear to have been registered in the standard sequence and its history is something of a mystery. It did, however, introduce a number of new features to the design. These included an extra cabin side window on either side, some alterations to the main undercarriage geometry and the adoption of much more angular fins.

This aircraft was soon followed by a second FN.333-S prototype which was built to production standards with a number of changes to the internal structure and was registered I-EUST in honour of Euste Nardi. It first flew on October 14, 1956, in the hands of test pilot G. Ferrari. Both of the first two prototypes were distinguishable by their small rounded rear quarter windows which were changed to a more angular shape on the final prototype (I-RAIG) and further enlarged on production aircraft. It is thought that only these three FN.333-S prototypes were built, although the position has never been completely clear. Other FN.333s to use "B Conditions" markings included I-RAIE, which has not been specifically identified.

AUTHOR'S COLLECTION



The wingtip floats were operated by two hydraulic actuators, and were fixed into their retracted position by means of mechanical locks. The manual recommended non-water landings be undertaken with the floats retracted, but the floats had sufficient ground clearance not to cause difficulties if they were not.

The cabin for the four-place production FN.333 was roomy and, according to a 1959 brochure for the type, "carefully designed to avoid corners and surface irregularities, which could endanger the occupants".

The water rudder at the stern of the hull was retractable during flight and lowered by means of a button on the pilot's control yoke. Once lowered, the water rudder was controlled with the rudder pedals.

The FN.333 was of all-metal construction with a cantilever wing. The hull was built with nine watertight compartments, each of which could be separately inspected and drained. During the refinement of the airframe to production standards the thickness of the skinning was increased as a result of a change from metric gauges to American standards, resulting in a very robust airframe stressed to 8·5g.

PHILIP JARRETT COLLECTION

A production FN.333 in the attractive red, white and black colour scheme that came as factory standard. To capitalise on the perception of the stylish Italian amphibian as a sophisticated European item of desire for the American market, the name Riviera was chosen and incorporated into the colour scheme.

GREGORY ALEGI COLLECTION

Certification testing of the prototypes proceeded during 1957–58 and eventually the *Registro Aeronautico Italiano* (RAI) issued *Certificato di Omologazione No A-91* which cleared the way for full production of the amphibian. The USA's Federal Aviation Administration issued Type Certificate No 7A5 on December 15, 1958, an essential part of the plan for the successful future marketing of the design.

Nardi had made an early decision that the FN.333 would not be built at its own factory in Milan and had come to an agreement with Fiat to manufacture the aircraft under licence. This meant that I-EUST and I-RAIG were built by Fiat at Turin, but, as the FN.333 programme became increasingly drawn out, Fiat withdrew and Nardi was forced to seek an alternative partner. In March 1959 Nardi came to a licence arrangement with SIAI-Marchetti SpA which set up an FN.333 production line at its Sesto Calende factory in the Lombardy region of northern Italy.

The Riviera comes to America

For the American market it was decided that the aircraft should be sold through Lane Aircraft of Dallas, Texas. SIAI-Marchetti would send basic airframes to Dallas where Southwest Airmotive would fit them with instruments, engines and propellers. It would then be the task of the Lane-SIAI company to handle marketing. The suitably exotic name Lane Riviera was to be used for the aircraft for all North American sales purposes.

The eventual production-standard FN.333 differed only slightly from the prototypes. The main undercarriage was completely redesigned with much shorter legs and was made to retract into the lower part of the hull rather than the fuselage

Nardi FN.333 Riviera data

Powerplant 1 x 250 h.p. Continental IO-470-P six-cylinder horizontally-opposed piston engine driving a 78in three-bladed or 82in two-bladed Hartzell constant-speed reversible-pitch propeller

Dimensions		
Span	34ft 1in	(10·40m)
Length	24ft 3½in	(7·39m)
Height	10ft 7½in	(3·24m)
Wing area	161·46ft²	(15m²)
Cabin height	47in	(1·20m)
Cabin length	114in	(2·90m)
Cabin width	42in	(1·07m)
Baggage space	15ft³	(0·425m³)
Weights		
Empty	2,150lb	(975kg)
Useful load	1,000lb	(455kg)
Maximum take-off	3,270lb	(1,485kg)
Performance		
Max speed	177 m.p.h. (285km/h) at sea level	
Cruise speed	164 m.p.h. (264km/h) at 8,000ft	
Stall speed with gear down, floats up, flaps at 45°	68 m.p.h.	(109km/h)
Take-off run		
ground	950ft	(290m)
water	1,565ft	(477m)
Landing run		
ground	660ft	(201m)
water	625ft	(191m)
Range at 55 per cent power	920 miles	(1,480km)
Max fuel capacity	63 US gal	(230·5lit)

A superb Kodachrome image of Riviera c/n 0103, which was bought factory-fresh by a Norwegian owner in September 1965 and registered LN-NPA. It is seen here in September 1966 at a fly-in in Belgium, where it would be put on the civil register as OO-HPA in 1968. It subsequently went to Finland as OH-SRA but was destroyed in a crash in May 1989. Photograph by MIKE HOOKS.

LEFT *The Riviera's wide doors made the sometimes challenging embarkation and disembarkation from a waterborne aircraft relatively simple, although the type never adopted the Republic Seabee's "docking/fishing door" in the nose.*

OPPOSITE PAGE *This scale drawing of the FN.333 comes from an unidentified Eastern European modelling magazine of the 1960s/1970s.*

BELOW *Riviera c/n 104, I-SIAI, in a variation of the standard colour scheme at Hannover Air Fair in May 1962. This aircraft was written off after an accident in April 1966.*

well above the water line. Other detail changes included elimination of the small fins attached to the wingtip floats, and improved interior fittings.

Setting records

Early in its career the Riviera amply demonstrated the merits of its design by establishing no fewer than six international records within the *Fédération Aéronautique Internationale* (FAI) classes for amphibians and seaplanes of 1,200–2,100kg (2,645–4,630lb). During July 21–23, 1960, with Giuseppe Alesini at the controls, the Riviera gained a height record of 6,950m (22,800ft), a 100km (62-mile) closed-circuit speed record of 271·78km/h (169 m.p.h.) and a 500km (311-mile) closed-circuit record of 268·95km/h (167 m.p.h.) in the seaplane class. In the amphibian category the height record came out at 7,189m (23,586ft), the 100km closed-circuit record at 270·27km/h (168 m.p.h.) and the 500km closed-circuit record at 268·91km/h (167 m.p.h.). All of this was used to good advantage by Lane in the marketing of the Riviera.

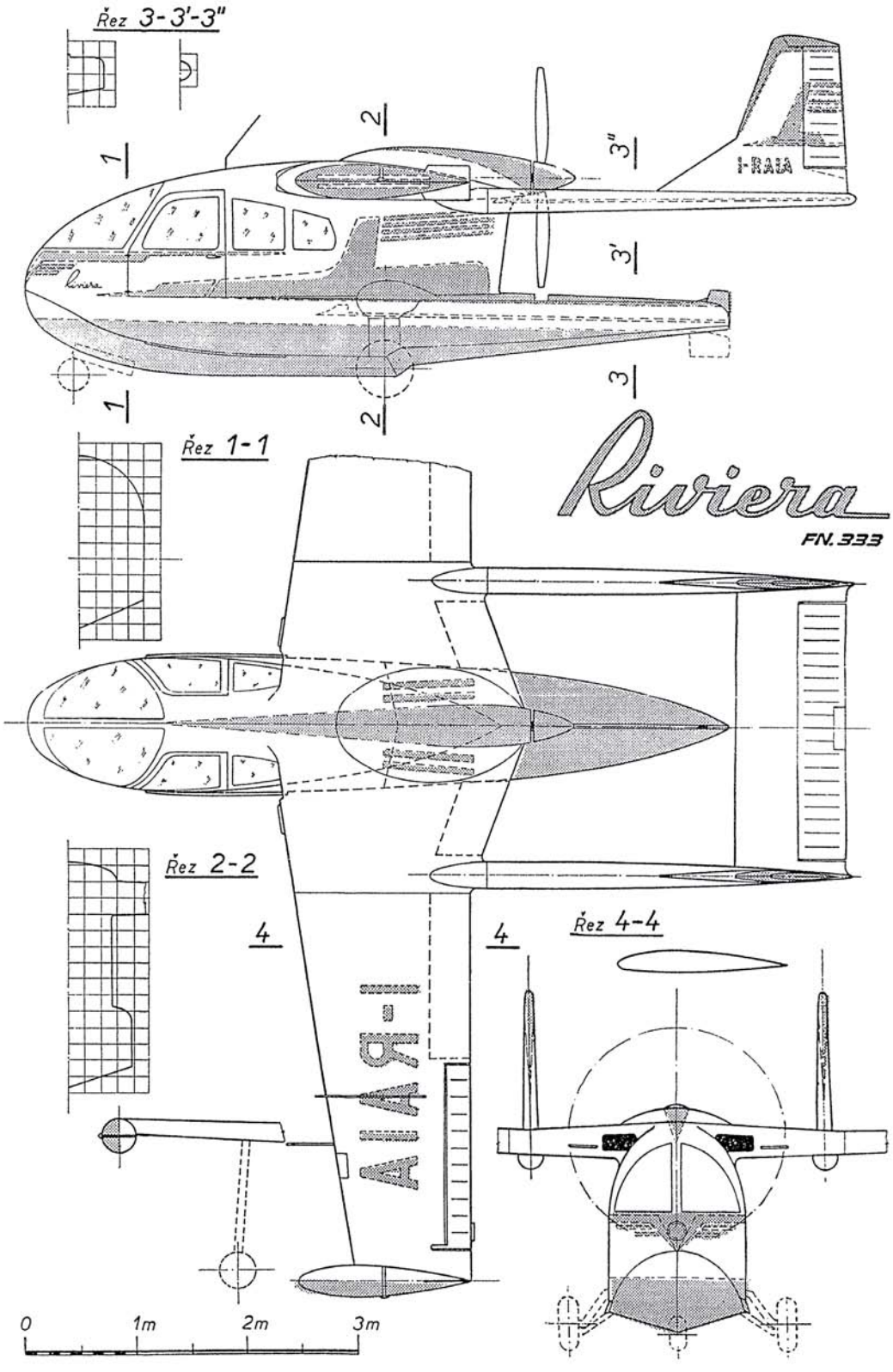
Production information for the FN.333 is difficult to unravel, sequences of construction numbers (c/ns) and registrations apparently being used more than once. It seems that two pre-production aircraft were built (c/ns 102 and 104) and probably a static-test airframe (possibly c/n 103). Production of an initial batch of 11 Rivieras was put in hand (c/ns 001 to 011), the first four being sent to the USA in late 1962. Pre-production FN.333 I-SIAI (c/n 104) had appeared at the Hannover show in May that year, but the bulk of the production aircraft were aimed at American buyers rather than at the limited European market.

A second batch of 12 Rivieras followed with construction numbers from 0101 to 0111 (plus the last with the odd c/n 12BIS) and all but seven of the 23-aircraft total production run completed by SIAI was sold to customers in the USA.

Flying the Riviera

With its powerful 250 h.p. Continental IO-470-P engine, the Riviera had impressive performance. At a gross weight of 3,000lb (1,360kg) the type's water take-off run was only 1,300ft (400m) after

MIKE HOOKS


Řez 3-3'-3"
I-RAIA
Řez 1-1
Riviera
FN.333
Řez 2-2
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1m
2m
3m

One of only three currently airworthy Rivieras, VH-SAV (c/n 0101) was the first of the second and final production batch. It was sold in September 1964 to an owner in Australia, where it still flies.

AUTHOR'S COLLECTION

which it would climb out at 1,200ft/min (365m/min). In keeping with other Italian light aircraft the controls were light and sensitive despite the Riviera being a comparatively heavy machine with a good number of drag-creating excrescences. On the water, however, it had to be handled with care. Early in the American sales programme it was felt that the hull's water rudder was inadequate and a larger unit was adopted.

On take-off pilots soon discovered that the nose of the aircraft had to be held down in the initial stages of the run in order to alleviate the aircraft's tendency for the bow to rise and send the machine into a porpoising routine. If this occurred, the only means of correction was to pull back the power and start again. In the alighting sequence it was essential to fly the aircraft right down to the point of water contact rather than allowing it to drop in.

So why did the Riviera not achieve more success in the USA? Probably the main reason was that the market for four-seat private amphibians was a limited one and the American-built Lake LA-4 was an established competitor which offered advantages over the larger Riviera. The selling price of the Riviera in the early 1960s, exclusive of avionics, was $34,954 compared with $26,580 for the Lake aircraft. It was certainly a faster machine and could fly for 920 miles (1,480km) without refuelling, substantially better than the LA-4's 627-mile (1,009km) range. But few passengers in an aircraft of this size are willing to sit for more than five hours without landing to stretch their legs, so the Riviera's "advantage" of long range may have ultimately worked against it. Nevertheless, the exclusive few who did invest in a Riviera were generally well satisfied with their purchase.

In 1966 SIAI-Marchetti decided that sales of the Riviera did not justify the production of a third batch of airframes and the type was discontinued. There had been plans for a pure seaplane version, designated the FN.333W, and further models powered by the 300 h.p. Continental IO-520 and 325 h.p. Continental TSIO-520 engines were announced as future possibilities. Ultimately, however, Nardi and SIAI were unable to turn these fine intentions into reality.

The exclusive Riviera club

Although the Riviera proved popular with its owners, more than half were written off in accidents. Among the survivors Australian example VH-SAV (c/n 0101) is still airworthy, its owner, Charles Riley, having dismantled and extensively overhauled the amphibian in 2005.

Two are still airworthy in the USA: N627 (c/n 002) was restored over a period of eight years by Rick Bertrand of Palm Springs, California, the aircraft making its first post-restoration flight on September 4, 2009; N993DM (c/n 0106) is believed to be still airworthy and based at Green Bay, Wisconsin. The number of airworthy Rivieras was sadly reduced by one when N95DR (c/n 0110) crashed in Minden, Nevada, on May 20, 2007, killing the pilot, Egon Fritz.

In January 2005 Riviera N5HL (c/n 102, formerly I-ELYO) was discovered being restored at a small airstrip in Rockwell, Texas, although it is not known how far this restoration has progressed. Another of the American Rivieras, N914NS (c/n 0108), is used for ground instruction at Chaffey College in California.

Of the three remaining examples in Europe, c/n 009 is stored at Bardufoss, Norway, c/n 0102 is under restoration at Rennes, France, and c/n 0104 is being restored by owner Dr J. Langhoff at Landshut, Bavaria. It is hoped that these projects will continue apace and European skies will again be graced with the Riviera touch.

ACKNOWLEDGMENTS

TAH *would like to thank David H. Marion for his help with the preparation of this feature, and recommends the websites of Steinar Saevdal (www.seabee.info) and Hendrik van der Veen (www.siai-marchetti.nl) for more on the Riviera*

Nardi/Fiat/SIAI-Marchetti FN.333 Riviera production

PRODUCTION INFORMATION REGARDING the FN.333 is notoriously difficult to untangle and the information below comprises what is known and best guesses. Airframes were built by SIAI-Marchetti unless otherwise stated. The table is divided into the four batches of construction numbers used in Riviera production. This information is based on the research of David H. Marion, Steinar Saevdal and Hendrik van der Veen

C/n	Registration	Remarks
(1)	Possibly **I-KISS**	First prototype, built by Nardi. First flight 4.12.52
(2)	Possibly **I-RAIE**	Second prototype (FN.333-S), built by Nardi. First flight 8.12.54
(3)	**I-EUST**	First example built by Fiat. First flight 14.10.56
(4)	**I-RAIG**	Second example built by Fiat. C of A issued 29.3.60. Accident 8.12.60, nothing else known
101	unknown	Possibly first example built by SIAI-Marchetti
102	**I-ELYO**	First flight 1961. To USA owner in Texas 27.10.99 as **N5HL**. Under restoration at Rockwell, Texas
103	unknown	Possibly static test airframe only
104	**I-SIAI**	Scrapped after accident on 2.4.66
001	**I-RAIA** (1)	Built by Nardi. First flight 4.12.58. To USA as **N73902** and later **N622**. Written off after accident on 7.10.64
002	**N73900**	Became **N627**. Airworthy
003	**N73901**	Became **N623**. Written off after accident on 10.3.72
004	**N8294E**	Became **N628**. Nosed over and crashed in water after porpoising on alighting at Tallahassee, Florida on 24.5.74. Injuries: 1 fatal, 1 serious
005	**I-SIAE**	Sold to owner in Norway as **LN-HHD**. Overturned at moorings in Bergen Harbour, Norway, on 5.7.65. Salvaged but written off 21.7.65
006	**N624**	Crashed while alighting with undercarriage extended at Three Lakes, Wisconsin, 19.8.65
007	**N625**	Stalled and crashed on approach to Akron, Ohio, after empty fuel tank selected, 25.10.68
008	Possibly **I-RAID**	Became **N626**. Struck object while alighting at Winter Haven, Florida, 2.9.68. Written off
009	**I-SIAU**	Used as demo aircraft in Denmark 1964. Sold to owner in Sweden as **SE-CWN** 12.5.67. Sold to owner in Norway as **LN-BEG** 20.6.73. Currently stored at Bardufoss, Norway
010	**I-RAIV**	C of A issued 16.4.66. Sold to owner in Belgium as **OO-DEA**. Became **OO-HEB**. Written off after accident at Heppignies, Belgium, 25.7.68
011	**SE-EEN**	Temporarily registered on Swedish civil register to Travelair Scandinavia AB of Norrkøping until 24.8.63
0101	**I-SAIO**	Sold to Australian owner as **VH-SAV**, 4.9.64. Passed through several owners. Airworthy at Tocumwal, New South Wales
0102	**I-RAIW**	C of A issued 16.4.66. Sold to owner in Belgium as **OO-DEB**, later **OO-HAR**. Sold to owner in France as **F-BTAM** 28.1.72. Currently under restoration
0103	**LN-NPA**	Sold to owner in Oslo, Norway, 1.9.65. Sold to a new owner in Belgium as **OO-HPA** in 1968, then to owner in Finland as **OH-SRA**, 8.9.69. Crashed on test flight after seven-year storage, 11.5.89
0104	**I-SIAM**	To USA in 1966 as **N918NS**. To Dr J. Langhoff of Landshut, Germany, 1994. Believed to be under restoration
0105	**N912NS**	C of A issued 10.10.66. Landed with undercarriage up on grass near Lansing, Michigan, fuel tanks empty, on 12.7.84. Probably written off
0106	**N916NS**	Damaged during wheels-up landing at Boston Airport, 24.9.67. To Canada as **C-GKMD** in 1977. Back to the USA as **N993DM** 20.8.02. Airworthy
0107	**N913NS**	C of A issued 15.12.65. Damaged during emergency landing at Pomona, California, on 15.10.68. Believed to be in storage at Green Bay, Wisconsin
0108	**N914NS**	Damaged on take-off after emergency alighting on lake at Sorrento, Florida, 12.11.66. Donated to Chaffey College, California, 1982
0109	**N917NS**	Destroyed in fatal accident at Shelton, Connecticut, 30.8.70
0110	**I-RAIA** (2)	C of A issued 8.3.66. To USA as **N6252**, becoming **N95DR** on 25.1.72. Destroyed in fatal accident at Minden, Nevada, 20.5.07
0111	**N632**	Damaged alighting on river, 17.4.65. Registration revoked 24.11.71
12BIS	**I-RAIA** (3)	To USA as **N591W**. Destroyed by fire 25.5.83

Armchair AVIATION

We take a look at what's available for the aviation history enthusiast in the world of books and other literature, from brand-new hot-off-the-press publications to reissued classics

Transatlantic Betrayal — The RB211 and the Demise of Rolls-Royce Ltd

By Andrew Porter; Amberley Publishing, The Hill, Merrywalks, Stroud, Glos GL5 4EP; 6¾in x 9¾in (172 x 248mm); softback; 160 pages, illustrated; £17.99. ISBN 978-1-4456-0649-1

THE CENTRAL ALLEGATION in *Transatlantic Betrayal* is a big one. In it the author, Andrew Porter, asserts, ". . . the Labour Government, together with the US administration, conspired politically to undermine the sovereign UK aviation industry, and therefore any positions of technological strength were to be negotiated away by the Labour Government to US interests in return for US agreement towards IMF financial support".

This allegation is very specific. And there's more. "With the Labour Government's push for an RB211-powered wide-body rather than an RB207-powered airbus, their politically-led preference indicated a willingness to subject the UK's crucial industry to be dependent on the US, despite European efforts to counter the dominance of the US aviation industry. The actions of the anti-airbus Labour Government and their cajoling of Rolls-Royce to secure US business are, I suggest, clear indicators of political forces used to achieve Rolls-Royce's over-reach scenario." This over-reach would be achieved by McDonnell Douglas and Lockheed either greatly delaying an order for the RB211 or imposing substantial re-engineering of the engine, especially in terms of thrust, and of imposing very onerous contracts.

Despite the author's assertion that the RB211 was superior because it was a three-shaft design employing high-pressure-bypass ratios, nothing much worked on the engine as it should have. Of the many disasters, the birdstrike test received the greatest coverage. All prototype jet engines have 4lb dead chickens, usually bought from the local supermarket, fired at them while running on a static rig. The effect of the chickens on the RB211's blades was disastrous. The carbon-fibre blades, on which Rolls-Royce had spent a fortune, were strong in two dimensions, but not in three. There is not a mention of any of the Hyfil blade problems in *Transatlantic Betrayal*.

Rolls-Royce had to go back to titanium blades, and thereby lost a very significant weight advantage, which meant a lower payload or a shorter range, or both. McDonnell Douglas started to walk away in favour of General Electric's CF6, which, in an earlier form, had powered the Lockheed C-5 Galaxy, and so had had most of the bugs taken out of it. Boeing opted for Pratt & Whitney's JT9D for the 747. That just left Lockheed's three-engined L-1011 and the twin-engined Airbus A300. The latter chose either Pratt & Whitney or General Electric as the years went by. Only Lockheed and its increasingly desperate chairman, Dan Haughton, hung on.

The titanium fan blades which replaced the Hyfil blades were not much safer. The need to meet the higher thrust demanded by Lockheed raised the high-pressure fan temperature from 1,100°C to 1,250°C. The strength of the blade halved for every 25°C between those temperatures, so a major effort to cool the fan blades became a serious life-or-death issue too, with Rolls-Royce eventually adopting Bristol-Siddeley's casting process. But there was more. The three turbine shafts were not showing the expected efficiencies. The engine was in a mess.

The responsibility lies firmly at the feet of Denning Pearson, the Rolls-Royce Managing Director, rather than the Americans, or Harold Wilson, or Denis Healey, or Tony Benn, who is

vilified throughout this book.

The Conservative governments of the 1950s had done their best to consolidate many small manufacturers, such as Miles, Fairey, Gloster and Folland, into consolidated aerospace businesses selling high-technology aircraft in large numbers, but the 1957 Sandys White Paper killed many of the projects. Harold Wilson's two 1960s governments were effectively bankrupt, but this did not mean the government thought that wrecking Rolls-Royce would save the day. The person best able to answer the author's charge is Tony Benn, the Minister of Technology during the RB211 disaster, and he is still alive, as is Denis Healey who was Chancellor of the Exchequer at the time. The book contains many speculations about Benn's contributions to the disaster, but there is no interview. Why not, or was the author rebuffed? The book lacks an index too, so it's difficult to know how many times Benn's name is mentioned, but it is a substantial number.

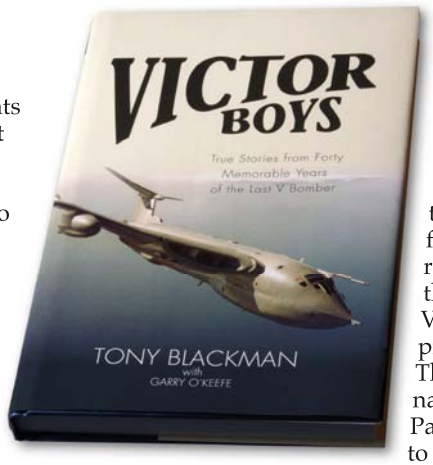
Everyone loves a conspiracy theory. This book is an enjoyable read but the truth is that a series of UK engineering cock-ups and a bankrupt government were to blame. I was standing in the Montague Arms in London's High Holborn at lunchtime on February 4, 1971, with my father, Bryan Greensted, who had been a test pilot. A man rushed in, clutching a copy of the midday *Evening Standard*, and shouted, "Rolls-Royce has gone bust!" I won't ever forget the silent collective shame of the drinkers in that pub, and probably everywhere else in the UK.

Later, in 1976, I married Sally, the daughter of Sir Stanley Hooker, who, in conjunction with the merchant banker Sir Kenneth Keith, rescued Rolls-Royce. Sanity was restored, and airframe manufacturers started buying Rolls-Royce engines once more. Businesses should be run by businessmen and -women, while governments should be run by politicians. Read this book and enjoy the yarn, but be grateful that leadership and sanity prevailed at Rolls-Royce in 1971 when the company needed it most.

STEPHEN GREENSTED

Victor Boys: True Stories from Forty Memorable Years of the Last V Bomber

By Tony Blackman with Garry O'Keefe; Grub Street Ltd, 4 Rainham Close, London SW11 6SS; 6½in x 9½in (165mm x 241mm); hardback; 214 pages, illustrated; £20. ISBN 978-1-90811-745-8



VICTOR FANS WILL enjoy this generous assemblage of first-hand accounts by a wide range of people involved with the famous crescent-wing V-bomber, from company test pilots to RAF groundcrew. Their tales are linked by a narrative tracing the Handley Page Victor's history from birth to retirement, and enhanced by a plethora of pictures, including 16 pages of colour images on glossy paper. The monochrome images dispersed throughout the text are often rather dark, and a great many are far too small for the reader to appreciate fully. It would also have been nice to see a proper photograph of the ill-fated H.P.88 research aircraft instead of a tiny plan-view silhouette.

Although the text could have done with some editing to insert some badly needed commas and create shorter sentences, it is both authoritative and informative. However, I would have expected this author to know what A&AEE stood for; it is given in the text as "Armament Experimental Establishment", and in the appendix of acronyms as "Aircraft and Armament Experimental Establishment".

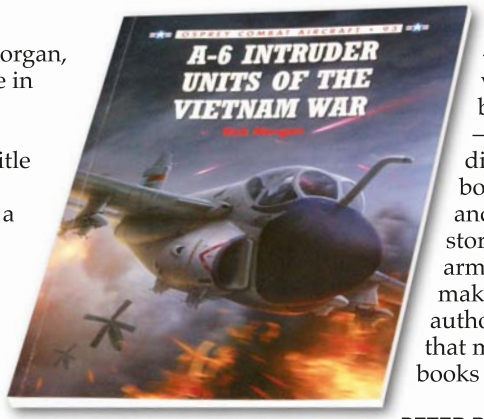
An interesting appendix describes Victor accidents, and there is a basic index, although perhaps aircraft types would have been better listed under their respective manufacturers rather than under "C130", for example, and I cannot recall ever before seeing RAF squadrons listed at the front of an index under the headings of their initial numerals: "1", "2", etc. Curious.

PHILIP JARRETT

A-6 Intruder Units of the Vietnam War

By Rick Morgan; Osprey Publishing, Midland House, West Way, Botley, Oxford OX2 0PH; 7½in x 9½in (190mm x 241mm); softback; 96 pages, illustrated; £13.99; ISBN 978-1-84908-755-1

GRUMMAN'S BIG, UGLY carrier-based bomber has generated comparatvely few books, including one produced by the author of this book and his brother Mark for Schiffer in 2004; a good book in a much larger format. A couple of wartime memoirs have also appeared to describe various individuals' experiences in Vietnam and



Operation *Desert Storm*. Rick Morgan, a Naval Flight Officer with time in several types, including the Grumman EA-6B Prowler, has written this much-anticipated title for Osprey, No 93 in its *Combat Aircraft* series, and he has done a fine job.

Gareth Hector's cover illustration shows the night mission flown by VA-196's Charlie Hunter and Lyle Bull against North Vietnamese ferry docks near Hanoi on October 30, 1967. The massive shape of the black-nosed Intruder is highlighted by blasts of flak and SAM bursts as it thrusts out of the darkness.

From there we proceed to a typical fact-filled text that describes the Intruder's development and fleet introduction, along with the problems this advanced aircraft had during these early stages. It is an interesting fact that the Intruder was never offered for export, while all its eventual companions, like the McDonnell Douglas F-4, Vought F-8 and Douglas A-4, saw service with other countries.

The author sheds new light on the US Marine Corps side of the A-6 story, including that of the "electric A-6" the EA-6A that fought the electronic countermeasures (ECM) war ahead of the more specialised EA-6B Prowler. He writes about the bombing missions flown deep into North Vietnam as part of *Rolling Thunder* because the USAF generals couldn't stand not having such a big gun in their line-up and knew the Intruder could amplify the efforts of the Republic F-105 Thunderchief and Boeing B-52 crews. Although the Marine Corps fought this predictable commandeering, almost piracy, of its assets, the "Leatherneck" crews certainly showed what they and their mounts could do.

The US Navy Intruder squadrons also gave good accounts of themselves, enduring serious losses as they fought their way in and out of thickets of flak and SAMs. It's all in here in 96 pages that cover the Vietnam combat career of this aircraft in a way that has not been done before, including very fine colour profile artworks by Jim Laurier that show off not only the A-6's unique lines but several examples of unusual underwing stores — World War Two-vintage M66 2,000lb bombs for example — which highlight the difficult period when full bomb loads were a rarity and use had to be made of stored caches of such ancient armaments. Osprey books make great use of the author-artist team in a way that many similarly intended books do not.

PETER B. MERSKY

Airship: Design, Development and Disaster

By John Swinfield; Conway, Anova Books Group, 10 Southcombe Street, London W14 0RA; 6⅛in x 9½in (165mm x 241mm); hardback; 368 pages, illustrated; £25. ISBN 978-1-8448-6138-5

THERE HAVE BEEN countless histories of airships, so this volume really needed to have something more to offer than its predecessors. In some respects it has, but it is something of a curate's egg. The author skates over some important aspects, such as the successful commercial Zeppelin operations before and after the First World War and even the wartime German military airship operations, but lavishes a far greater share of space on British airships than all the rest, which creates an imbalance, especially in view of the book's title. A quick look at the contents page makes this evident, and the chapters devoted to "Italy, Norway and Russia", American airships and the *Graf Zeppelin* and *Hindenburg* (a mere 11 pages for this one) are conspicuously shallower in their coverage.

While the author goes into great detail regarding British airship programmes and disasters, he is vague and inconclusive about the *Hindenburg* event, only touching on possible causes. When it comes to the R101 disaster, however, we have a glut of quotes and assessments from a variety of other publications and people, and the author plays an impartial mediator's role.

As well as diagrams contained

within the text, there are three eight-page sections of black-and-white images and one of colour. The "previously unseen archive photography" is not impressive, much of it being poorly chosen. The rather fuzzy Willows airship is not specifically identified, the only image of the *Norge* consists mainly of the crew hauling on ropes, while that of *Roma* shows only a tiny area of its envelope as background to a group of unidentified worthies. The colour section is equally disappointing, starting with a picture relating to ballooning and containing nothing outstanding.

Perhaps the most interesting section is the appendices, wherein one finds a transcript of the log kept by R101's first officer, and hitherto unseen material from the Granville Watts collection. The book concludes with notes, a bibliography and an index.

PHILIP JARRETT

Military Aviation in Northern Ireland: An Illustrated History — 1913 to the Present Day

By Guy Warner and Ernie Cromie; Colourpoint Books, Colourpoint House, Jubilee Business Park, Jubilee Road, Newtownards BT23 4YH; 9½in x 8in (241mm x 203mm); softback; 120 pages, illustrated; £8.99 ISBN 978-1-78073-038-7

THIS IS ESSENTIALLY a pictorial history, the images being arranged in chronological order and provided with beefy captions to create an entertaining light read. The authors have obviously gone to some trouble to assemble a good collection of images from numerous sources, many of which will be unfamiliar to most readers. Some are grainier and less sharp than others, but this is acceptable, given the wide variety of professional and amateur photographers involved.

The story opens with the first overseas deployment of the Royal Flying Corps in 1913, to take part in the Irish Command manœuvres, and ends with the recent work of the Irish Air Corps. In between we have a great assortment of fixed- and rotary-wing aircraft, personalities, airfields and aircraft carriers, in both black-and-white and colour. The book's value is greatly enhanced by the well-researched and informative captions.

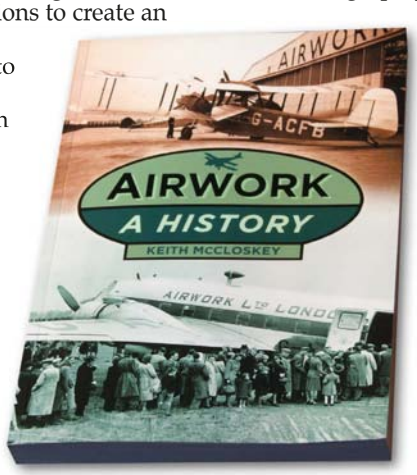
PHILIP JARRETT

Airwork: A History

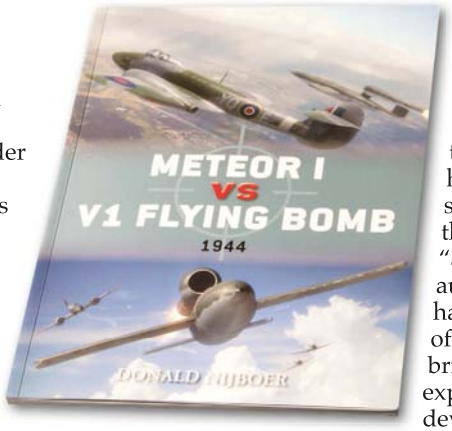
By Keith McCloskey; The History Press, The Mill, Brimscombe Port, Stroud, Glos GL5 2QG; 6¾in x 9¾in (172mm x 248mm); softback; 272 pages, illustrated; £17.99 ISBN 978-0-7524-7972-9

AIRWORK AND ITS associated companies, as the author points out in his foreword, had a finger in so many pies all over the world that each of this book's 39 chapters could easily be "expanded into books in their own right". However, such a collection of tomes would be unlikely to find a sufficient market, so we will have to be content with this one volume. It will surely satisfy most readers, and many will doubtless be astounded by the company's wide involvement in aviation.

Founded by Frederic Muntz and Nigel Norman in 1928, Airwork Ltd was initially intended to manufacture and deal in "aeroplanes, flying machines, airships and aerial conveyances of all kinds" and to act as "garage and hangar keepers, aerodrome proprietors, cinematograph proprietors and film makers, etc". Although Norman died in a flying accident in 1943, the businesses were kept going and expanded by Muntz until his retirement in 1974. Airwork Ltd and Airwork Services are now owned by the Babcock International Group plc.



The author divides his 39 chapters into five sections. The first, "Early Days", covers company development, associated companies and the airports at Heston, Whitchurch, Barton and Gatwick. "Airline and associated Civil Activities" come next, with 622 Sqn



RAuxAF, Blackbushe, Airwork Atlantic, Deutsche Flugdienst GmbH and Fison-Airwork under the spotlight. Section three, "Overseas", surveys operations in 12 countries, often establishing airlines, while the fourth section spotlights Airwork's involvement in RAF, Royal Navy and Army training and maintenance. The last section, a survey of miscellaneous contracts, is followed by useful appendices listing the aircraft connected with the various companies, sources and further reading and a rather basic index.

The author has amassed a good and varied selection of monochrome images covering all periods and subjects to accompany his text. This is one of those volumes for which you probably will not have felt a need until you open its pages and discover what you have been missing.

PHILIP JARRETT

Meteor I vs V1 Flying Bomb

By Donald Nijboer; Osprey Publishing, Midland House, West Way, Botley, Oxford OX2 0PH; 7¼in x 9¾in (184mm x 248mm); softback; 80 pages, illustrated; £12.99; ISBN 978-0-84908-706-3

THIS IS A rather unusual subject for the 45th title in the *Osprey Duel* series, but it makes a refreshing change from the conventional fighter-versus-fighter theme. Britain's first jet fighter, the Gloster Meteor I, was rushed into service in July 1944 to form part of the defence against the V1 flying-bomb, and this book covers the evolution of both aircraft, beginning with engine and protoype design and development: initially the Whittle-powered Gloster E.28/39 in the case of the Meteor, and early trials of the pulse-jet engine used in the V1.

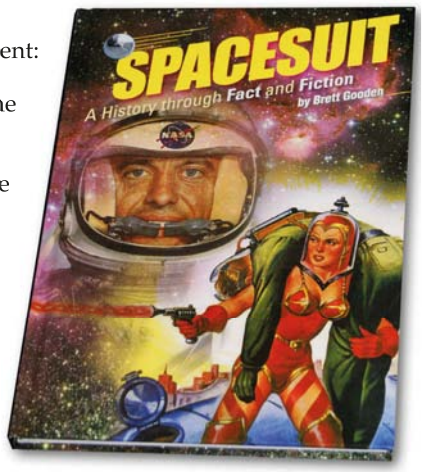
Technical specifications for the two combatants come next, followed by an overview of the strategic situation, RAF pilot training and the training and testing of V1 units. It could be debated whether the term "combat" is correct when describing attacks on V1s, as the uncontrolled winged missiles were unable to engage or manœuvre when attacked by an aircraft, but that is the next chapter heading. Then come the statistics and an analysis of the episode, plus the "aftermath", in which the author concludes that the V1 had no effect on the outcome of the war, and then looks briefly at subsequent Allied V1 experiments and Meteor developments.There is a good quantity of colour artwork, including three-views of both types, and colour and black-and-white illustrations support the text.

PHILIP JARRETT

Spacesuit — A History through Fact and Fiction

By Brett Gooden; Tattered Flag Press, PO Box 2240, Pulborough, West Sussex RH20 9AL (also available via www.casematepublishing.co.uk); 6¾in x 9¾in (174mm x 250mm); hardback; 128 pages, illustrated; £16.99; ISBN 978-0-95481-154-4

FIRST, A DECLARATION of partiality from your reviewer — I like this book; so much so that we ran an excerpt from it in the last issue of *The Aviation Historian* — see *Mercury Rising* in *TAH3*. Sussex-based publisher Tattered Flag shares with this journal a penchant for the more unusual, offbeat aspects of history, which it presents in well-thought-out and attractive books. This fascinating history of the spacesuit — both in reality and in the imaginations of the authors of classic *Dan Dare*-style science-fiction (and where they intersect in some cases) — is that rare entity in the often airless atmosphere of technological history publishing; a book which is both highly entertaining and packed with facts. From 18th Century beardies in balloons to the sprawling space stations of the future, the challenges of developing textiles and life-support systems for the most hostile environments on earth — and far beyond — are detailed with wit and authority by an author who clearly knows his subject.



NICK STROUD

Lost & Found

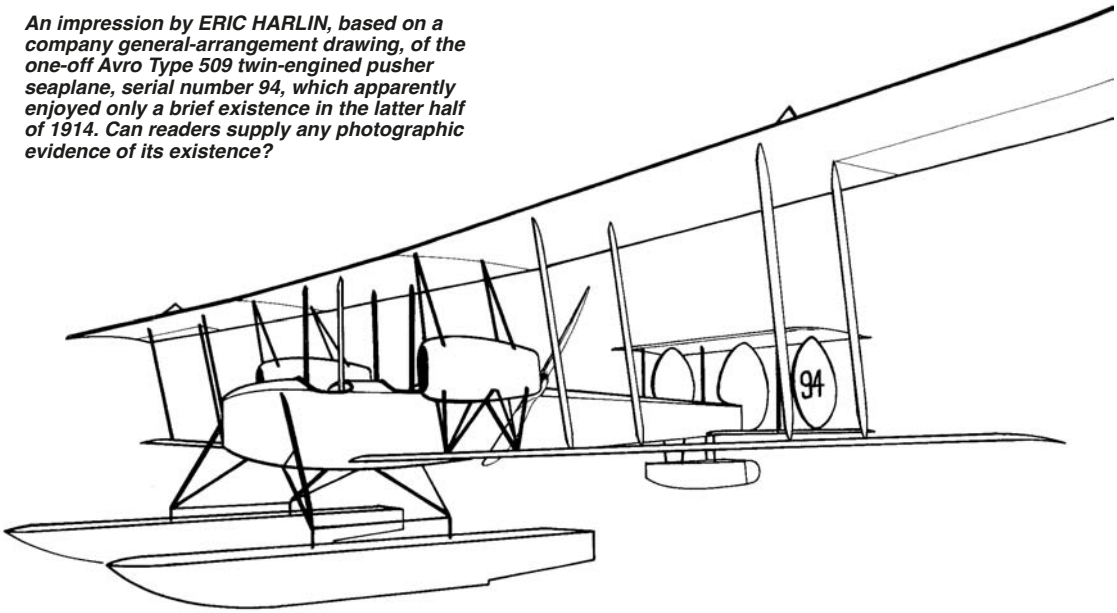
PHILIP JARRETT explores the lesser-known corners of aviation history, discovering unknown images and rediscovering long-lost details of aircraft, people and events. This time he takes a look at an early Avro seaplane about which very little appears to be known

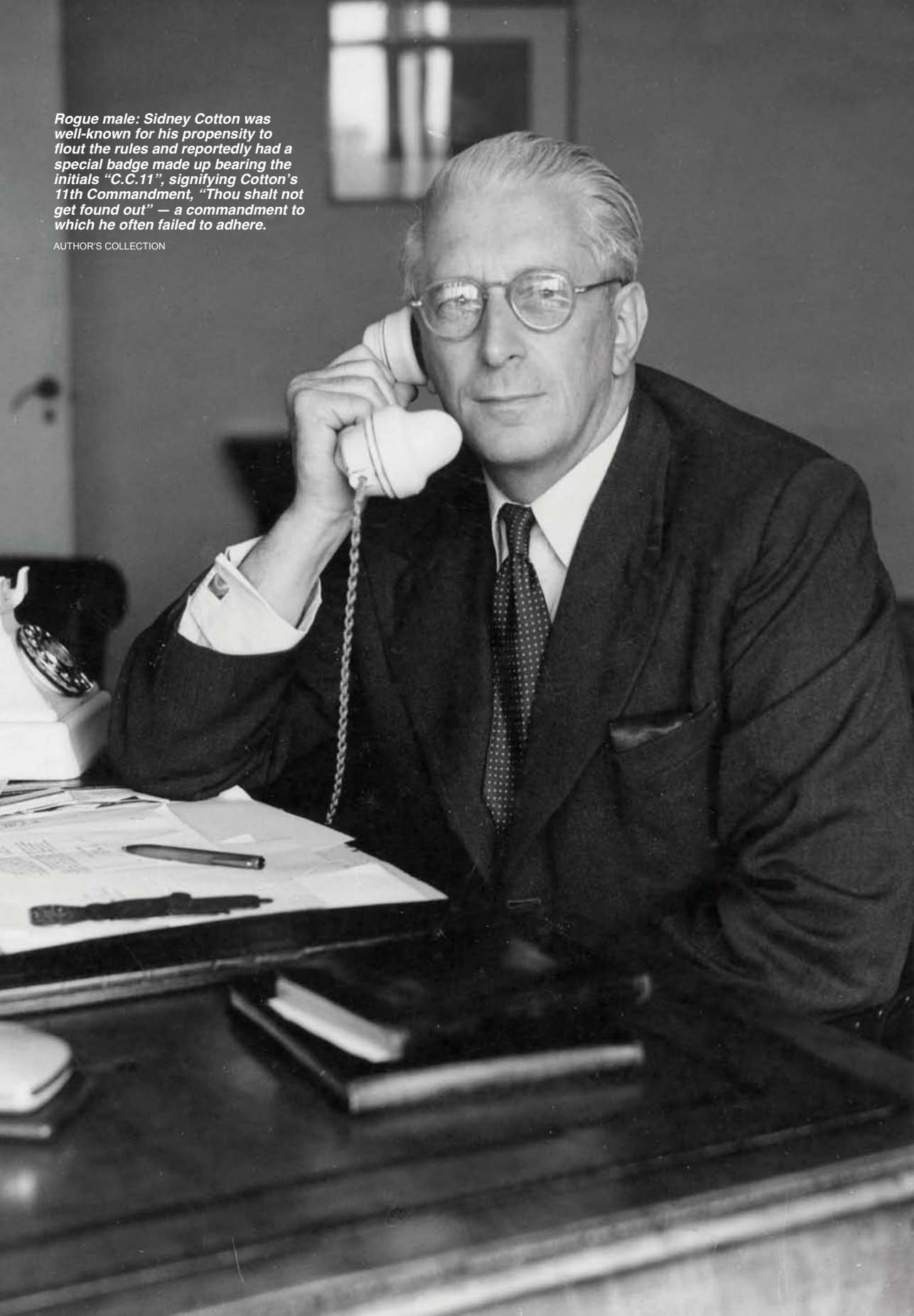
IN THE PERIOD immediately before the First World War and in the conflict's early stages, a few British aeroplanes eluded photographers. One of these was the Avro Type 509, a biplane seaplane powered by a pair of watercooled in-line engines mounted in mid-gap and driving pusher propellers. Designed to carry a heavy gun, the 509 was ordered for the Admiralty in January 1914 under Contract CP.10760/13, valued at £3,384. On order for the Naval Air Station at the Isle of Grain in Kent until at least June 1914, it was allocated serial number 94.

It has been written that the aircraft was not built, but *Flight* reported in its issue for June 12, 1914, that "two [Avro] hydros are to be delivered to the Navy shortly". The July 10 issue stated: "…the Avro firm are building two large waterplanes for the Navy. One is a 160 h.p. tractor biplane [a Type 510], whilst the other is a large machine of the 'pusher' type, measuring 80ft across the wingtips. Two Austro-Daimler engines, each of 120 h.p., will drive the two separate propellers situated behind the main planes. The engines are not interconnected in any way, as Mr Roe contends that it will be possible to fly the machine with one engine running by using the rudder and ailerons". The Type 509 was 44ft 3in (13·49m) long, had estimated tare and all-up weights of 2,800lb (1,270kg) and 4,510lb (2,046kg) respectively, and was expected to achieve a top speed of 70 m.p.h. (113km/h).

In its September 2, 1914, issue *The Aeroplane* reported that "a new type of Avro pusher" had recently been "flying well" over Southampton Water, adding in its September 9 issue that the new machine "does not appear as good as the tractor of the same make". In the October 1914 list of His Majesty's Naval Aircraft – Built, Building and Under Repair, Avro Seaplane No 94 is said to carry two passengers, and to have an endurance of 4hr and a maximum speed of 55 m.p.h. (89km/h), which might well have proved disappointing. At the time the list was compiled the aircraft was allocated to the Isle of Grain and was still "on order". On October 7 *The Aeroplane* reported that the new Avro pusher was in use at Calshot, and a week later added that it had "flown very well". That is the last that is heard of this obscure machine, and its fate seems not to have been recorded. The accompanying drawing by Eric Harlin provides an impression of its appearance, but does a photograph lurk in some dusty archive or private album?

An impression by ERIC HARLIN, based on a company general-arrangement drawing, of the one-off Avro Type 509 twin-engined pusher seaplane, serial number 94, which apparently enjoyed only a brief existence in the latter half of 1914. Can readers supply any photographic evidence of its existence?





Rogue male: Sidney Cotton was well-known for his propensity to flout the rules and reportedly had a special badge made up bearing the initials "C.C.11", signifying Cotton's 11th Commandment, "Thou shalt not get found out" — a commandment to which he often failed to adhere.

AUTHOR'S COLLECTION

ABOVE ***Avro Lancaster XPP CF-CMW was one of nine Lancasters converted for civil use by Victory Aircraft in Canada. It was later acquired by Sidney Cotton for his nefarious activities in Hyderabad.***
PHILIP JARRETT COLLECTION

GUN COTTON

Sidney Cotton's aviation achievements were many and varied; the Sidcot flying suit and his contribution to photo-reconnaissance are legendary. Far less well-known, however, are his post-war gun-running adventures in India, as **JEFFREY WATSON** reveals . . .

ONE OF SIDNEY Cotton's favourite sayings was that there were two sorts of fish in the river. There were those who were always swimming against the current, snapping at everything that swam by, and those who sat in a hole in the bank and waited for the big one to come along. Sidney Cotton was definitely of the second variety.

Cotton is best known as the father of aerial intelligence and the mastermind behind a series of secret flights over Nazi Germany in the late 1930s. Less well known is his gun-running operation into the Indian state of Hyderabad in 1948. Cotton's fortunes expanded and contracted like the bellows of a concertina. One minute he was a millionaire, the next he was broke. But, according to one estimate, his mission to supply weapons to the beleaguered Nizam of Hyderabad netted him a cool £4m.

FROM BULLS TO BOMBERS

Cotton was born near Proserpine in the Whitsunday region of Queensland, Australia, in 1894, the son of wealthy cattle baron Alfred Cotton. He learned to fly in England and enlisted in the Royal Naval Air Service, flying bombing sorties during the First World War. Between the wars he flew in Newfoundland on seal-spotting missions and started an airmail service.

In 1938 he was approached by British Military Intelligence to fly spy flights over Germany, which led to the formation of the RAF's Photographic Reconnaissance Unit, a key factor in the Allies' ultimate victory. But Cotton was relieved of his command before the start of the Battle of Britain and for the rest of the war received the cold shoulder from the military hierarchy.

In post-war Britain it was not easy to make a living out of aviation — London was full of demobbed RAF pilots seeking work with the airlines. It was only with the establishment of Indian independence in 1947 that Cotton saw a chance of making his fortune. Sidney smelled big money. The big fish was Mir Osman Ali Khan Siddiqi, the seventh Nizam of the Indian state of Hyderabad. Reputed to be the richest man in the world, the Nizam was the only prince in India to carry the title "Exalted Highness". His riches included £100m in gold bullion and £300m in jewels. Among the gems was the 185-carat Jacob Diamond, which he used on his desk as a

paperweight. Despite his enormous wealth, the Nizam was known to be a misanthropic skinflint who wore a cheap secondhand suit and a fez encrusted with dandruff, and smoked cigarette ends left behind by his guests.

When the British withdrew from India in 1947, the 500 princes, maharajahs, rajahs and the Nizam were given the option of becoming part of India, which was predominantly Hindu, or joining the Muslim state of Pakistan. The Nizam, a Muslim, decided he wanted to be independent of both and was prepared to fight.

CASH ON DELIVERY

The Nizam was keen to establish a pro-British enclave in India, and told Sidney Cotton he was prepared to spend £20m on weapons. His shopping list ranged from small arms and ammunition to 25-pounders and anti-aircraft guns. Cotton agreed to take on the job, but insisted on being paid in cash. In post-war Britain, pilots were ten a penny. Cotton shopped around in London and found that Aer Lintas, the intercontinental division of Aer Lingus, had abandoned an earlier decision to run an Atlantic service, and as a result a dozen crews were threatened with redundancy. Cotton hired eight three-man crews consisting of a captain, first officer and wireless operator, and bought Avro Lancastrians and Lancaster XPPs from Skyways, Silver City Airways and Trans-Canada Air Lines. These were G-AJPP (re-registered AP-ACN), G-AKJO (AP-ACO) G-AHBZ (AP-ACQ) and CF-CMW (AP-ACM) and CF-CMX (AP-ACL).

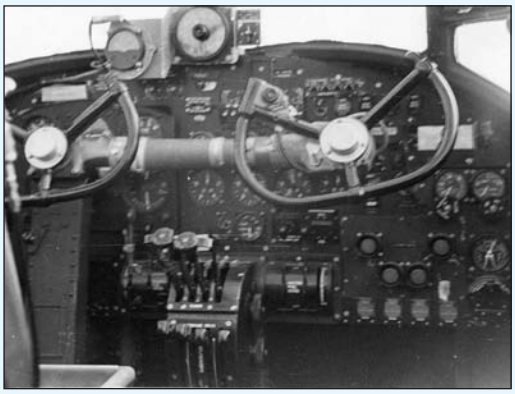
Ray Coles (not his real name), who today lives in Sydney, had trained on Bristol Beaufighters and de Havilland Mosquitoes during the war but had no experience on Lancasters. In 1947 he was ferrying Supermarine Spitfires from England to Turkey and being paid £40 plus expenses for the round trip. Cotton offered him double his salary, plus danger money, to fly Lancastrians from Karachi to Hyderabad and land them at disused military airfields at Bidar and Warangal at night. The aircraft would home in on a radio transmitter and Cotton arranged to

AUTHOR'S COLLECTION

ABOVE ***The richest man in the world — Mir Osman Ali Khan Siddiqi, His Exalted Highness The Nizam of Hyderabad in a rare portrait. The pro-British Nizam provided financial support to Britain during the Second World War and numbered Winston Churchill among his close personal friends.***

BELOW ***The other Lancaster XPP acquired by Cotton was CF-CMX, which was registered to OnzeAir in Pakistan as AP-ACL in 1948. Unlike its sister, it survived the gun-running operation and was returned to the UK in late 1948, after which it was scrapped.***

PHILIP JARRETT COLLECTION



THE LANCASTRIAN: FROM WARHORSE TO WORKHORSE

THE AVRO LANCASTER had barely entered service in February 1942 when plans were put in place to create a transport variant for transatlantic services between the UK and Canada. A Mk III was converted to carry passengers and mail, which set a record flight time of 12hr 26min from Dorval to Prestwick in July 1943. Nine Mk Xs were similarly converted by Victory Aircraft in Canada and designated XPPs in Trans-Canada Air Lines service. After the war Avro put the transport variant into production as the Lancastrian, 82 of which were built in four variants.

"Like everything else in Cotton's life, it was a gamble, but he believed the Indian Air Force would be reluctant to fly its Hawker Tempest fighters at night. He was right . . ."

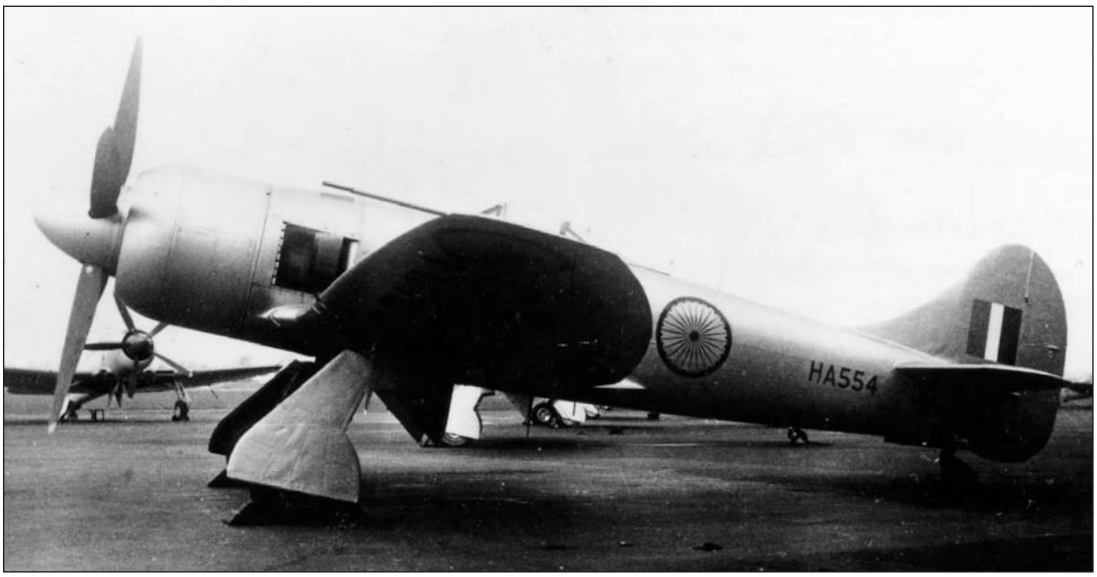
have the flarepaths lit with a single line of kerosene lamps. Ray recalls: "We got £1,000 each trip, split between the crew and we gave £100 to the bloke who looked after the flarepath in Hyderabad. This was hazardous flying, involving flying 1,000km [620 miles] into Indian territory, but it was the monsoon period, and there was plenty of cloud cover".

Like everything else in Cotton's life it was a gamble, but Cotton believed that the Indian Air Force would be reluctant to fly its Hawker Tempest fighters at night. He was right. The cargo was claimed to be medical supplies, and although Cotton's pilots sometimes flew these as part of their cover, the bulk of the freight carried was guns. Sometimes the boxes of weapons were too big to go through the door of the Lancastrian, so they were unpacked and the contents laid out on the floor of the cabin. There were always worries about weight distribution, and a shifting load was believed to have caused the crash of AP-ACM during a flight from Rawalpindi to Mauripur airfield, near Karachi, on August 1, 1948. A field gun was believed to have broken loose during the approach and the aircraft crashed on the field, scattering guns over a wide area. This was seized upon by the Indian press as clear proof that Cotton was running guns, not vaccines.

"WHERE ARE YOUR TEMPESTS?"

With astonishing hubris, Cotton dared the Indian Air Force to shoot his aircraft down. On one occasion he deliberately flew over an Indian fighter airfield in broad daylight, knowing that the Tempests were looking for him. Then he sent a radio message to Pandit Nehru, the Indian Premier, asking: "Where are your Tempests?"

The operations lasted until September 18, 1948, when Hyderabad surrendered to the Indian Army. Four Tempests attacked Hakimpet airfield at Hyderabad and dropped a bomb on one of the two runways. The chief engineer at the airfield, Frederick Rowan, was shot and his body dumped in a ditch. Cotton flew off into the

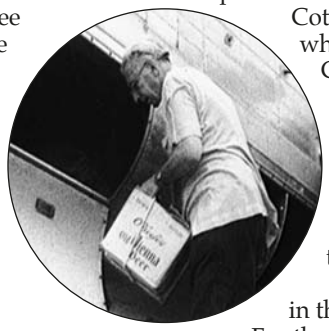


PHILIP JARRETT COLLECTION

ABOVE ***The Indian Air Force acquired some 124 Hawker Tempest IIs from RAF squadrons leaving India in 1946. An order for another 89 was placed the following year, with 20 more arriving in India in 1951, making a total of 233.***
INSET BELOW ***Sidney Cotton loading a box into the bomb bay of one of the four-engined transports in 1948.***

sunset with a box full of money in the rear of the aircraft, guarded by a Pathan guard with an antique rifle. Ray Coles remembers that the boxes were crammed with 100-Rupee notes in bundles of 100, each bundle worth £750.

Hyderabad was incorporated into the state of India, and the Nizam's wealth gradually eroded. When he died in 1967 the Nizam was succeeded by his grandson, who now lives in exile in Istanbul.



BACK TO BLIGHTY

The story had a strange twist for Ray Coles. When he arrived back in London he realised that his pilot's licence might be revoked if it was discovered he had been carrying munitions in a civilian aircraft. So he went to Rhodesia to start a flying school; something he would not have been able to do had he not been so handsomely rewarded by Cotton. Even now Ray feels that some might not take kindly to his part in the operation!

Cotton himself had to face the music when he returned to London in 1949. Charged under the Air Navigation Act with carrying arms and ammunition, he was fined a paltry £200. Winston Churchill was said to have intervened so that Cotton got off lightly. Meanwhile, the Lancastrians were impounded by the Pakistani government.

Like the fish who waits in the hole in the bank, Sid had caught the big one. For the next ten years he swanned around the Mediterranean on his yacht, the *Amazone*, courting the rich and famous, and commuted from England to Cannes in his Lockheed 12, G-AGTL. Nevertheless, when he died in 1969 Cotton had lost his fortune and left this world virtually penniless.

A poor-quality but rare photograph of Lancastrian 4 G-AKJO, still wearing its British registration, at Karachi in 1948. It became AP-ACO in service with Cotton's OnzeAir organisation but by 1949 was back in the UK, where it was probably scrapped.

AUTHOR'S COLLECTION

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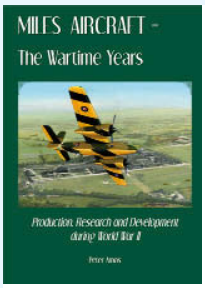

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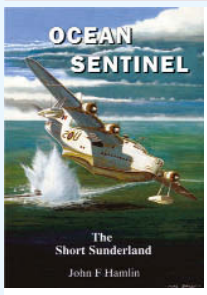

OCEAN SENTINEL
The Short Sunderland *John F Hamlin*

From the manufacture of the Sunderland in several different locations, the type development and operational roles, the book moves on to detail the many military units, British and of other nationalities, with which the flying-boat served worldwide. The individual histories of every aircraft are catalogued, including those of Australian, New Zealand, South African, French and Portuguese forces. Civil conversions and the development of the Sandringham, Seaford and Solent variants are also covered. Operators, routes and individual histories are fully described.

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AUTHOR'S PHOTOGRAPHS

Off the beaten track...

Ever turned a corner to find something unexpected? The Aviation Historian's *intrepid aeronautical explorer* ***PETER DAVISON*** *investigates the stories behind the oddities that turn up in the most unusual places*

THE BELLANCA CRUISAIR is rarely seen in aero-club hangars, so imagine my surprise on finding this immaculate example in Ilopango, San Salvador. The National Museum of the Salvadoran Air Force holds a mixed bag of military aircraft and memorabilia tracing various conflicts and developments in this Central American republic.

The Cruisair Senior was first shown in 1946 at the Cleveland National Aircraft Show, and was one of the first cabin monoplanes designed for touring. It is a noteworthy connection that it was a Bellanca type that Chamberlin, Levine and Acosta flew non-stop from New York to Germany in just over 50hr in June 1927, one month after Lindbergh's solo flight, and that Lindbergh's Ryan monoplane, *Spirit of St Louis*, made a visit to Ilopango in 1928 that is celebrated in the museum.

A key feature of the Cruisair was its empennage, which had endplates fitted to the tips of the tail-plane. The cabin interior featured an overhead radio speaker, map and glove compartments and ashtrays. The type featured a moulded Plexiglas windscreen, the cabin walls were lined with thin glassfibre sheet and the upholstery was mohair fabric trimmed in leather; no sign of post-war austerity in corporate aviation. What's new?

ABOVE ***Used and donated by Mr F.E. Thompson, a local businessman, Bellanca 14-13 Cruisair Senior YS-64P (c/n 1626) retains its original 150 h.p. Franklin 6A4-335-B3 engine, which allowed a very respectable cruising speed of 150 m.p.h. The type made its first flight on November 13, 1945, and some 600 were ultimately built.***

BELOW The 1940s-vintage air terminal at Ilopango Airport that was the nation's national and international gateway until 1970. This rather weary Douglas A-26 Invader is one of the larger exhibits at the museum.

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